The Electrical Industry's Weekly Magazine

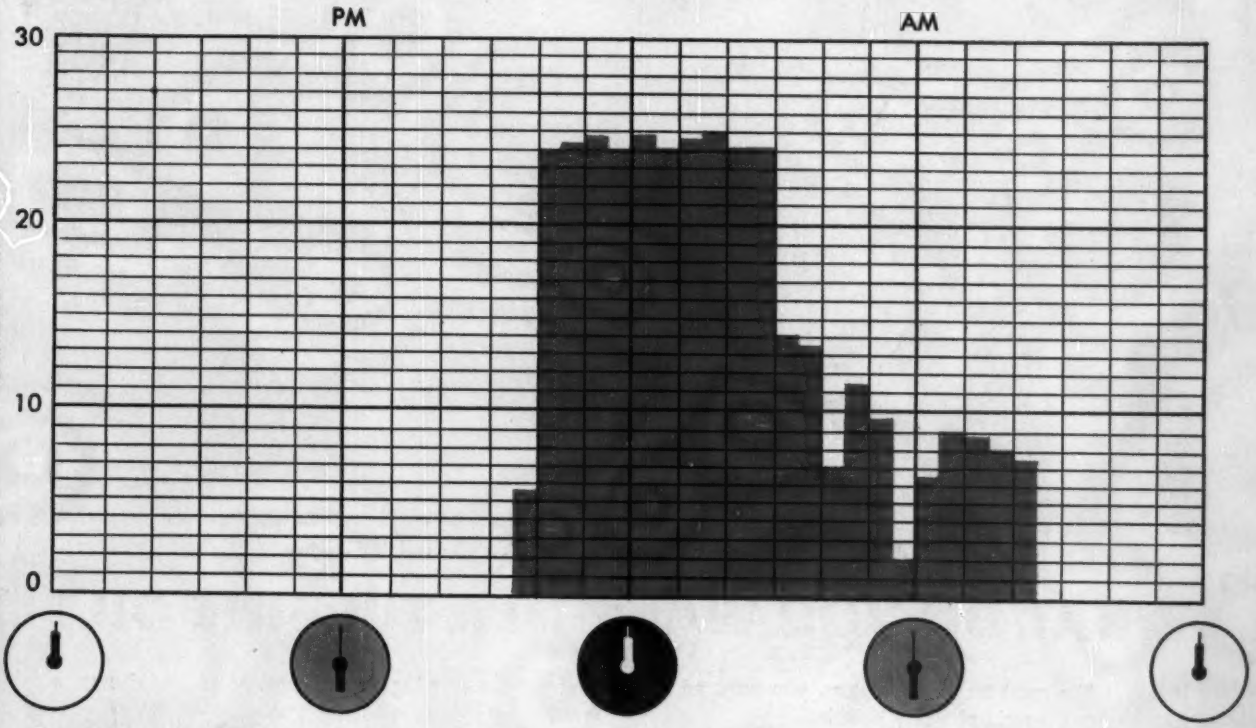
November 11, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Why Not Off-Peak Heating and Cooling?



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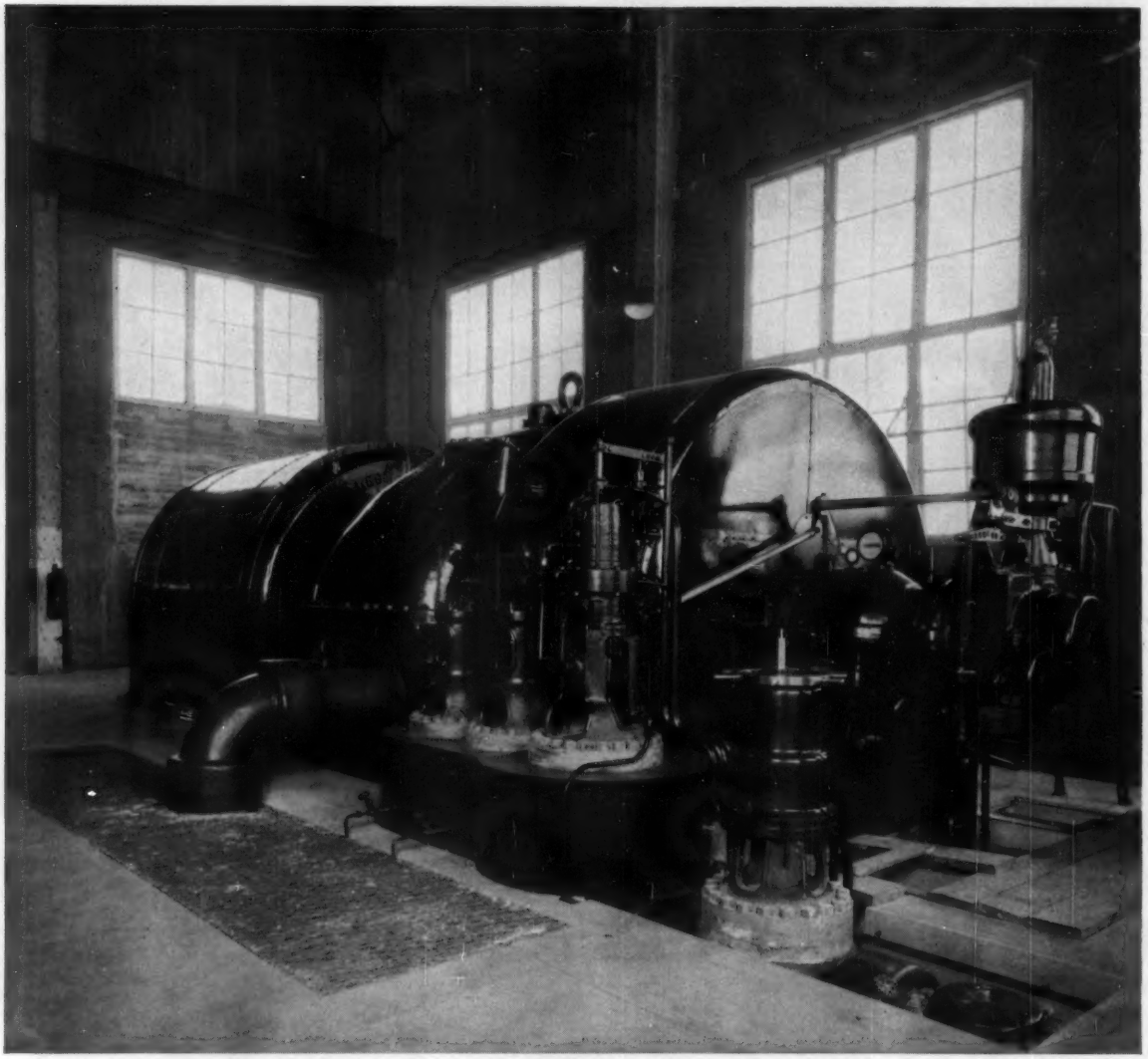
SPECIAL MEETING REPORT: Association of Edison Illuminating Companies..... Page 58

ANN ARBOR MICH
313 N 1 ST
UNIVERSITY MICROFILMS IN
E R POWER
GS W L



This turbine has been Texaco-lubricated for 26 years . . . is still on original bearings.

WHAT DO YOU WANT IN A TURBINE OIL?

If you're like most turbine operators, you want an oil with an extra margin of safety built in.

That invariably means *Texaco Regal Oil R & O*.

In addition to lubricating and cooling moving parts, *Texaco Regal Oil R & O* protects your system against rust, sludge and foam. And it has an exceptionally long service life. There are turbines that have been Texaco-lubricated for 30, 40 or more years.

There is a complete line of *Texaco Regal Oils R & O* to meet the exacting requirements of all manufacturers, regardless of turbine size or type.

A Texaco Lubrication Engineer will gladly help you select the right *Texaco Regal Oil R & O* for your turbine. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States—or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, New York.

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TEXACO Regal Oils R & O

FOR ALL TURBINES

Electrical World

Vol. 148, No. 20 November 11, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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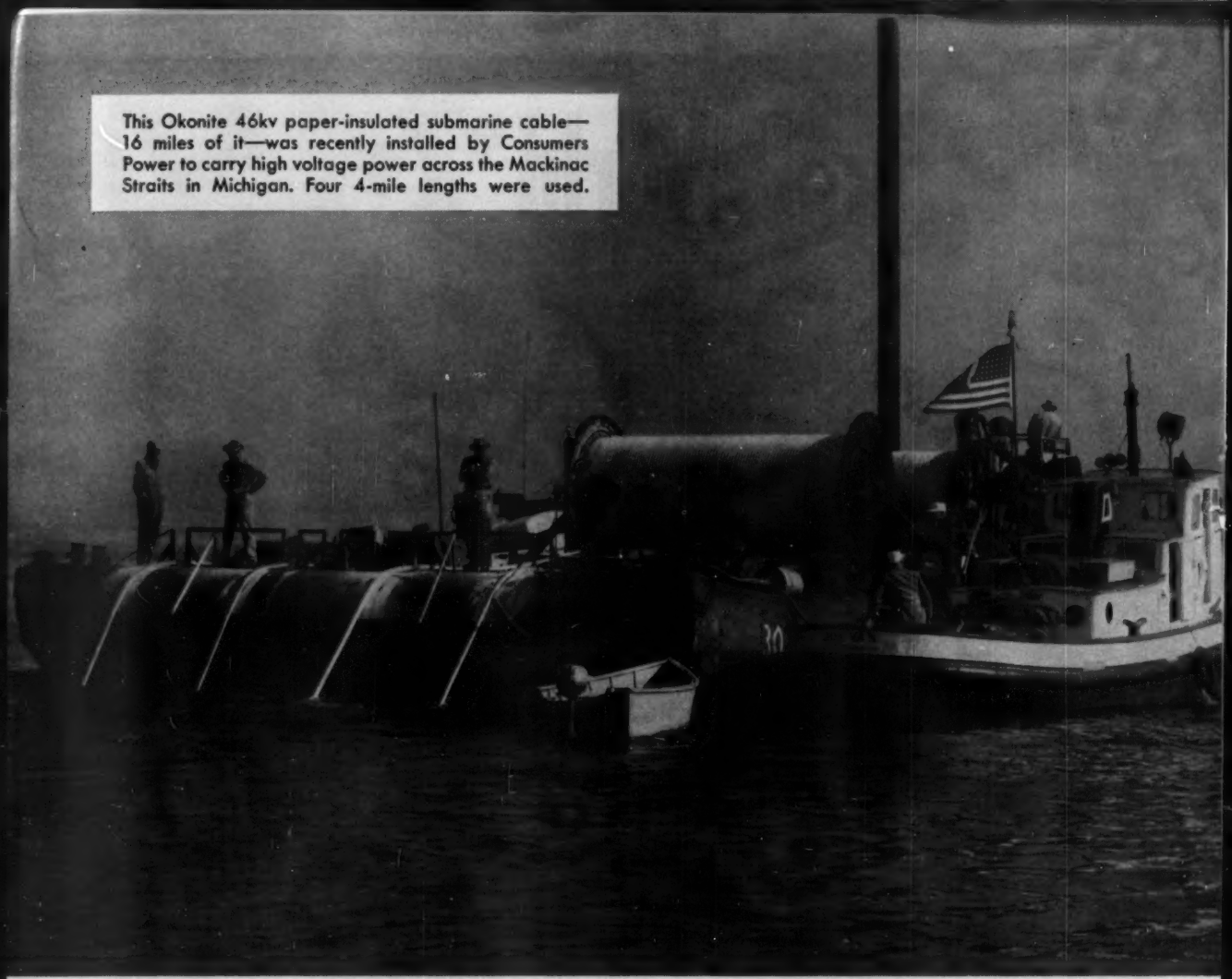
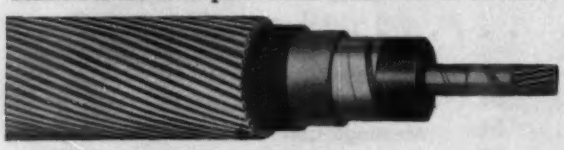


This Okonite 46kv paper-insulated submarine cable—16 miles of it—was recently installed by Consumers Power to carry high voltage power across the Mackinac Straits in Michigan. Four 4-mile lengths were used.

New Consumers Power circuit links upper and lower Michigan for first time

For critical power installations like this one, leading utilities most often place their confidence in Okonite.



Okonite solid type paper-insulated 46 kv submarine cable

Here's why.

With few exceptions, paper-insulated cables are purchased under the basic AEIC specification. But this "spec" does not take into account the experience, the manufacturing methods, or the service records of the manufacturer. And when you buy a cable like the one illustrated above, *these assurances of extra quality are of utmost importance to you.*

Combine these with the carefully researched and tested components of Okonite paper-insulated cables and you have real circuit security. Available with either copper or aluminum conductors, these features are discussed in detail in Bulletin EW-1052. Write for it today. The Okonite Co., Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

4320

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. . . from the publisher

Your business magazine serves you best when it furnishes information to broaden your job horizons. Here is the sixth in our current series to help you get at more of that information in less time.

Tip 6 – Use the Departments

Want to know what's happening to that bill some congressional sub-committee is kicking around? Or what date that next T&D meeting will be held in St. Louis? Between Electrical World's covers you find 18 specialized editorial departments—each with the special job to cover your special interests. There's the Washington Wire to keep you abreast of the Capitol happenings that affect the industry—perhaps your job. There's the Atomic Progress page, the Meetings Calendar, Manufacturers and Markets section, the popular News About People.

Engineers can pick up work short-cuts and money saving ideas in the "How To" department . . . find basic technical data in the Engineering Reference Sheets. For the sales force, there's Selling, Heating & Cooling Electrically, Industrial Applications.

Departments and their page numbers are listed near the bottom of the Contents Page (page 3). Get to know the ones that have most use to you.

Fischer Black

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Get 3 Tanks for best protection

It Takes More Than One Tank for That Extra Margin of Protection

Here's big breaker construction in a small outdoor distribution breaker! It costs you no more, so why take less?

Compare this breaker with others of the same rating and see the difference. Allis-Chalmers breakers offer:

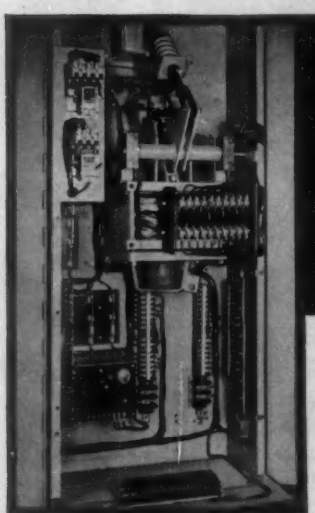
Tank-per-phase construction — Phases are completely isolated to eliminate internal phase-to-phase flashover and provide maximum protection on today's low reactance systems with their corresponding high fault currents.

Two vertical breaks per phase — Using time-tested *Ruptor* devices.

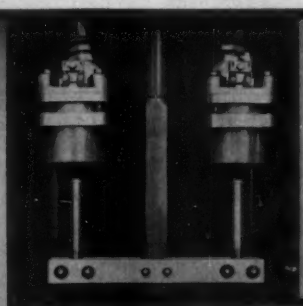
Standardized control wiring — Wiring meets NEMA and AEIC standards. Permits breaker to be moved from one location to another without the need for complete rewiring, as in the past.

Get More Information! For the complete story call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

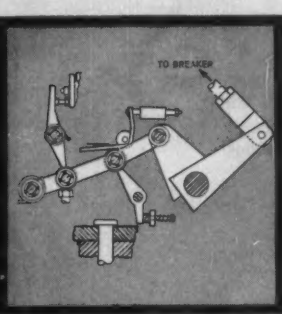
Ruptor is an Allis-Chalmers trademark.



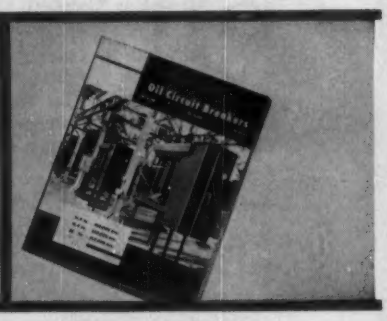
AEIC-NEMA standardized control wiring facilitates changing external control scheme to meet individual requirements without changing basic internal wiring scheme.



Two vertical internal breaks per phase... features time-proved, fully tested *Ruptor* interrupting devices with self-wiping, self-aligning tulip and bayonet contacts.

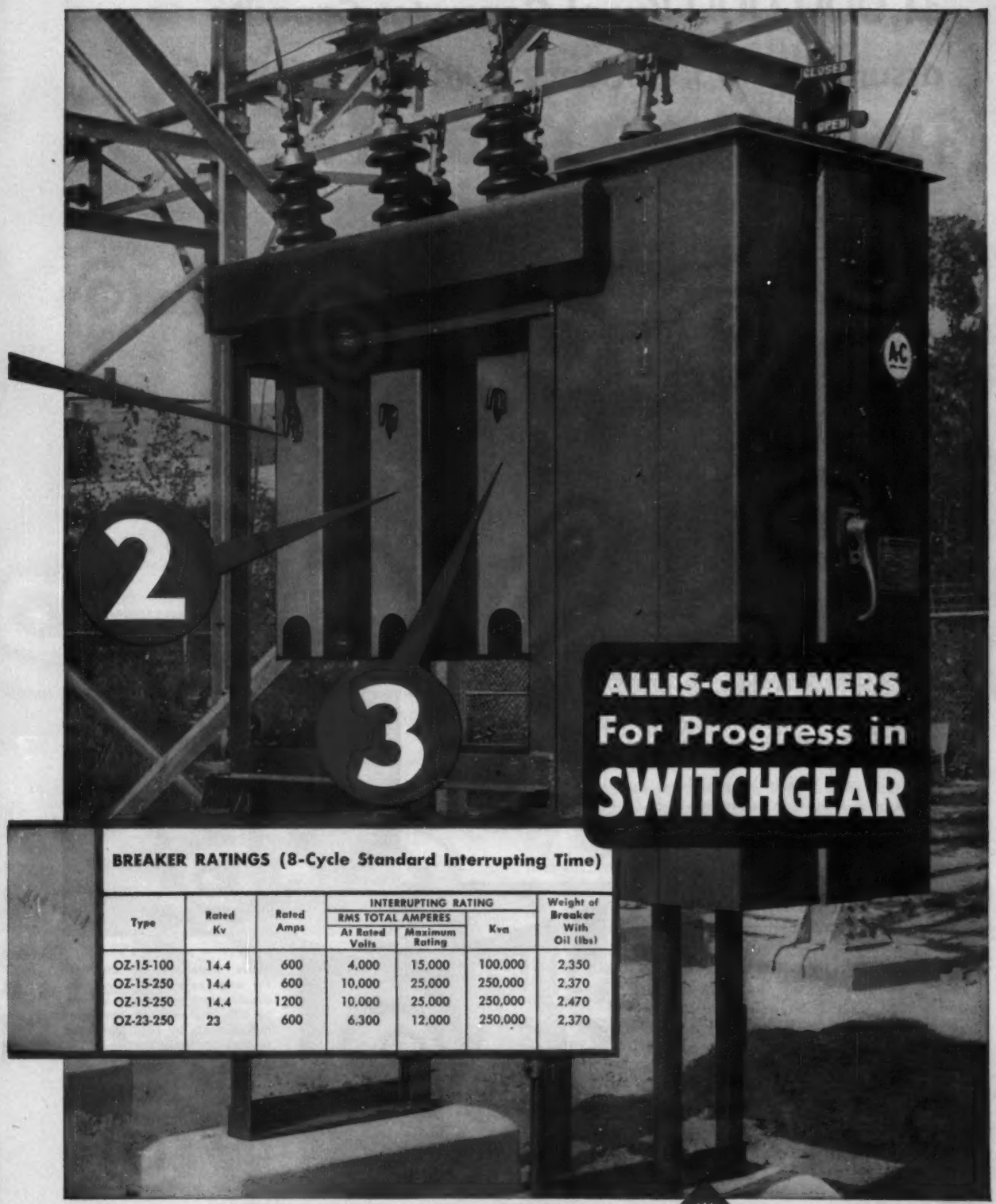


Four-bar linkage like ones on large A-C breakers provides mechanically trip-free operation. Simple solenoid operator—factory-set shim adjustments cut maintenance.



Eight-page bulletin 71B7946 tells the complete story. It shows the many quality features ordinarily found only in the larger breakers built into these units.

ALLIS-



ALLIS-CHALMERS For Progress in SWITCHGEAR

BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Kv	Rated Amps	INTERRUPTING RATING RMS TOTAL AMPERES		Kva	Weight of Breaker With Oil (lbs)
			At Rated Volts	Maximum Rating		
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

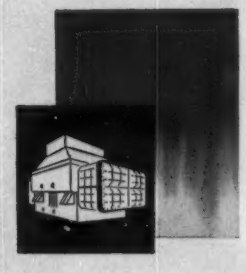
CHALMERS

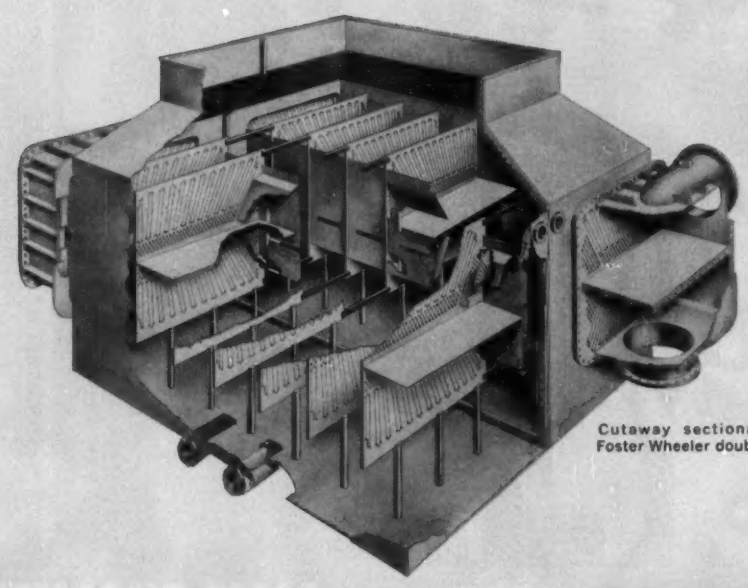
A-C ALLIS-CHALMERS

A-5144

31,000,000 Kw of Generator Capacity is assured of top efficiency with CONDENSERS

HEAT ENGINEERED by FW

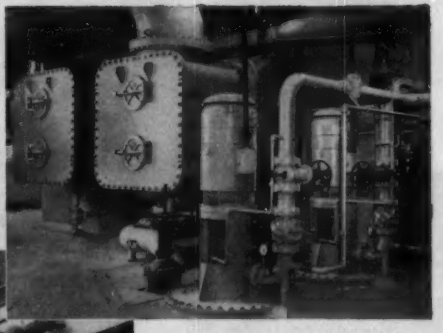


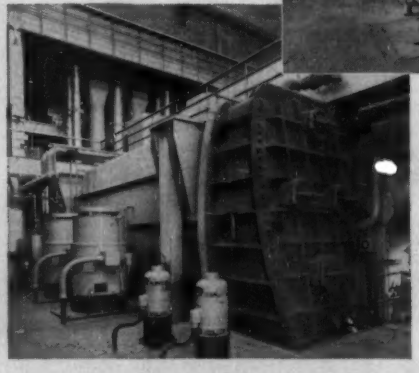


Cutaway sectional drawing of a typical Foster Wheeler double-flow, two-pass condenser.

The heat engineering of a surface condenser involves essentially the same problems as that of a steam generator — but applied in reverse. Heat must be removed from the exhaust steam as quickly and efficiently as possible with minimum pressure drop and maximum condensate temperature. Foster Wheeler's specialized know-how in heat engineering has been applied to advantage in the continual improvement of condenser designs for higher efficiencies and greater economies of installation and operation.

Today Foster Wheeler has installed or is building steam surface condensers for 31,000,000 kw of generator capacity — including 115 turbo-generators of 100,000 kw capacity or *larger*, with a total output capability of over 16,000,000 kw. This number of large FW units is an indication of their outstanding acceptance by the power industry. And the high percentage of repeat orders reflects the dependability and long-term economy of Foster Wheeler condensers as demonstrated by on-the-job performance in leading power plants from coast to coast.





Above: Installation of the first FW single-pass, double-flow condenser which cut overall volume by 60%, and reduced headroom requirements by 40%, compared to previous designs.

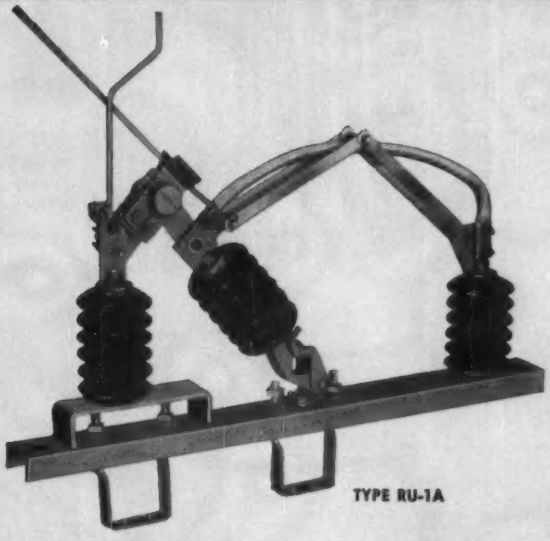
Left: One of two FW 70,000 sq ft side-turbine-exhaust units serving a 145,000 kw turbo generator. This unique design permitted a basement-to-turbine-floor height of only 15 feet.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

For low-cost switching choose a Southern States tilting insulator disconnect

TYPE TR-1A



TYPE RU-1A

TWO COMPLETE LINES

When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one —but two complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA Standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

The Type RU-1A is a distribution level tilting insulator switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA Standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed disconnecting switches. So can you. Get full details in our Bulletins 54 RU and 3050.

EASY INSTALLATION

One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

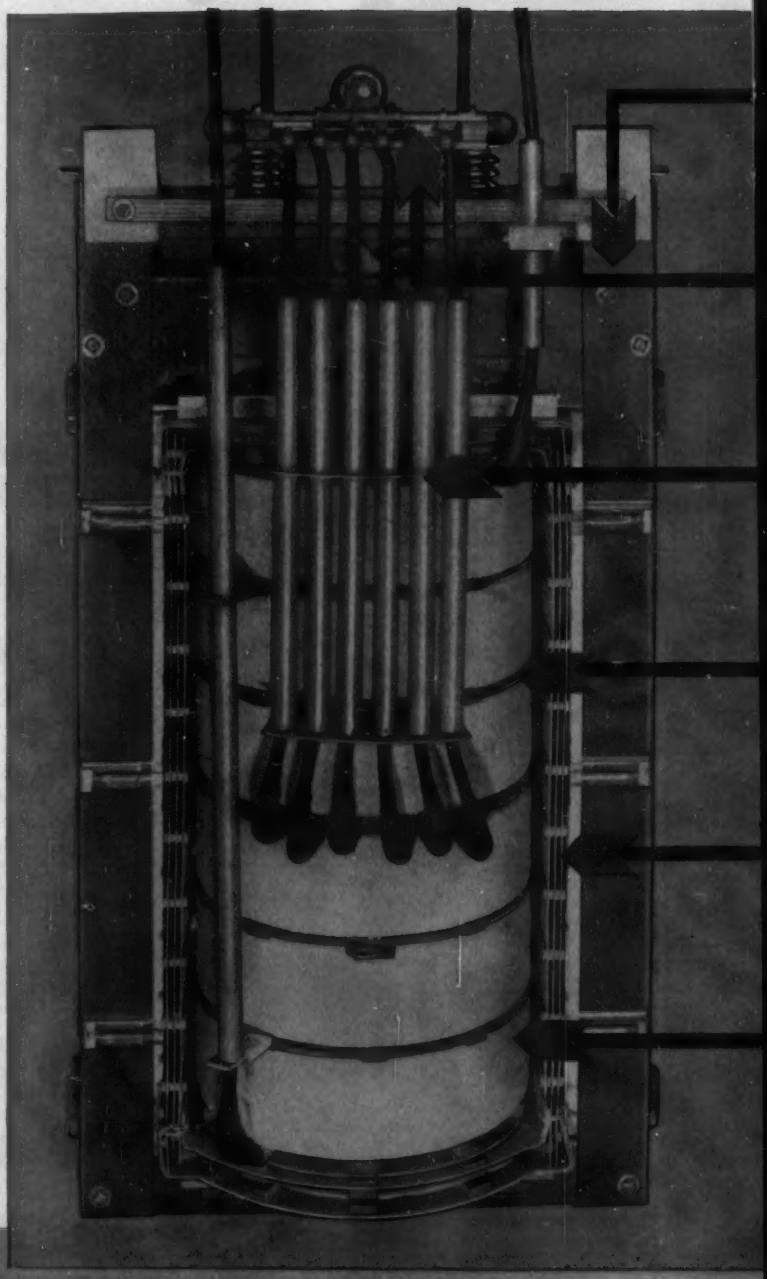
Internal Ruggedness...

POLE STAR

As a general rule, the higher the voltage, the more essential it is that transformer service be continuous and trouble-free. This is true from the standpoint of economics as well as that of customer satisfaction . . . and it is why Pennsylvania gives you *extra* ruggedness where it counts the most, in high voltage Pole Stars.

Take a look at the interior design features shown on these pages and see for yourself. From the patented lap-on-top core to little noticed lead supports, Pole Stars are designed and constructed to deliver *sustained performance* in every type of transformer installation. You can rely on Pole Stars for long range economy and dependability throughout the complete range of EEI-NEMA ratings: through 500 kva, through 67,000 volts, single phase. Pennsylvania Transformer Division, McGraw-Edison Co., Canonsburg, Pa.

The unit pictured is 500 kva. High voltage: 67,000 volts. Low voltage: 7560/13,090Y volts. Construction features shown may vary somewhat in other voltage classes.



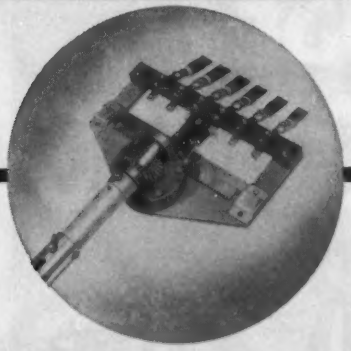
PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA

key to sustained performance of high voltage

POLE STARS

ANGLE-AND-CHANNEL CORE FRAME



Core-and-coil assembly is supported by a sturdy, pressed steel, angle-and-channel frame, which is securely fastened together by bolts with permanently positioned nuts.

STRAIGHT-LINE TAP CHANGER

Straight-line tap changer is of same rugged design as that featured for years on Pennsylvania Power Transformers. Sintered silver-nickel contacts possess electrical qualities of silver and wearing characteristics of nickel.

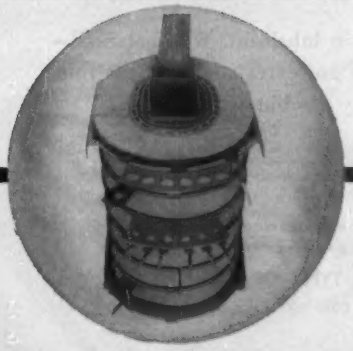
INTEGRAL LEAD SUPPORTS

High voltage leads are insulated in pressboard tubing and held firmly in position by supports that are an integral part of the coil.

LAP-ON-TOP CORE

Core features Pennsylvania's patented lap-on-top construction. Laminations are individually lapped, creating a large cross-section area at lap that reduces density and prevents concentration of flux. Absence of gaps or butt joints assures low exciting current.

INSULATION AND BRACING

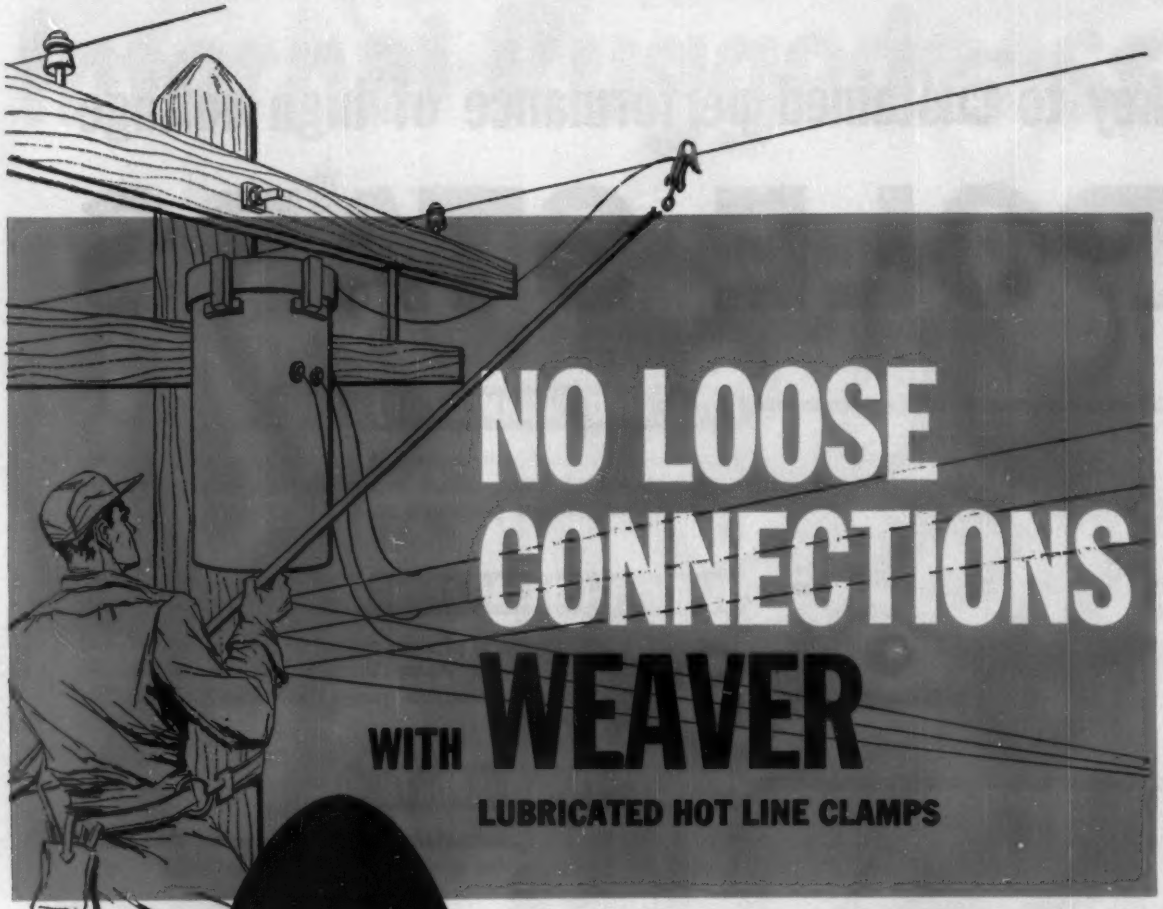


Coils are "packed out" with insulation to securely lock core and coil together. Maple braces provide extra support at top and bottom and help to protect against possible short circuit forces.

SECTIONAL COIL

High voltage windings are sectional, with low voltage layer windings inside. Use of sectional coils in higher voltages improves insulation . . . permits weight and size reductions. Also results in uniform distribution of impulse voltage and greater resistance to short circuit.

DISTRIBUTION TRANSFORMERS



NO LOOSE CONNECTIONS WITH WEAVER

LUBRICATED HOT LINE CLAMPS

HERE'S WHY: You tighten them tighter! Apply up to 400 inch pounds tightening torque without distortion. PERMANENT HIGH PRESSURE CONNECTIONS.

They stay tight! High-tension spring maintains constant pressure between clamp and line. Can't loosen from vibration, load variations, temperature changes. NO COSTLY OUTAGES FROM ARCS AND BURNED LINES.

Easily removed—Bolt cased in lubricant. Well-balanced—Won't hang horizontally and put extra strain on the line. For aluminum, copper or any combination.

TWO SIZES FOR ALL REQUIREMENTS. WHY CARRY NEEDLESS INVENTORY?

Samples are available for your engineering department on request. No charge, of course.

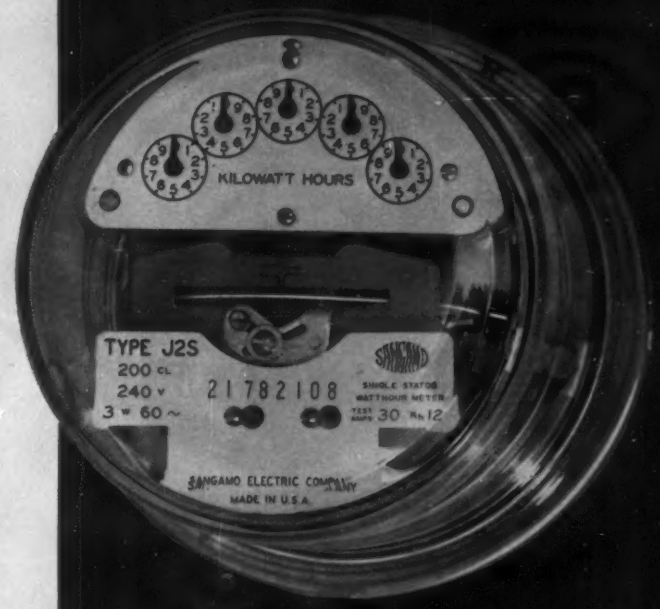
WEAVER OFFERS 8 ADDITIONAL TYPES OF HOT LINE CLAMPS . . . *write for catalog.*

J. A. WEAVER Company

2110 HOWARD STREET ST. LOUIS 6, MO.

CEntral 1-8100

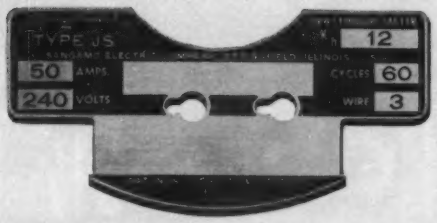
What's new in Class 200 Meters?



With more and more 200 ampere service entrance equipment being installed every day, it's sound practice to match service capacity with metering capacity.

The Sangamo Class 200 Meter can accurately measure all loads—from a few watts to full 200 ampere capacity. Yet the development of 200 ampere capacity meters is nothing new with Sangamo. The Class 200 Meter is backed by 17 years of *proven performance.*

THE NAMEPLATES TELL THE STORY...



IN 1940

Sangamo introduced the Type J Meter, a radical departure in singlephase meter design. It accurately registered loads as great as 200 amperes. The 50 amp. J Meter gave excellent load curves up to such loads as the current carrying capacity of the terminals would allow. These J Meters are on your system—available to do tomorrow's job.

IN 1955

Sangamo developed the J2 Meter—the first extended range meter—a refinement of the basic J Meter. The Type J2 incorporated many improvements over the Type J... increased bearing life, higher resistance to surge voltage, superior voltage characteristics, improved corrosion resistant finishes and materials. The 50 amp. J2 Meter offered straight line accuracy to 200 amperes with only 18 starting watts. These meters are on your lines—ready and waiting for bigger loads.

NOW

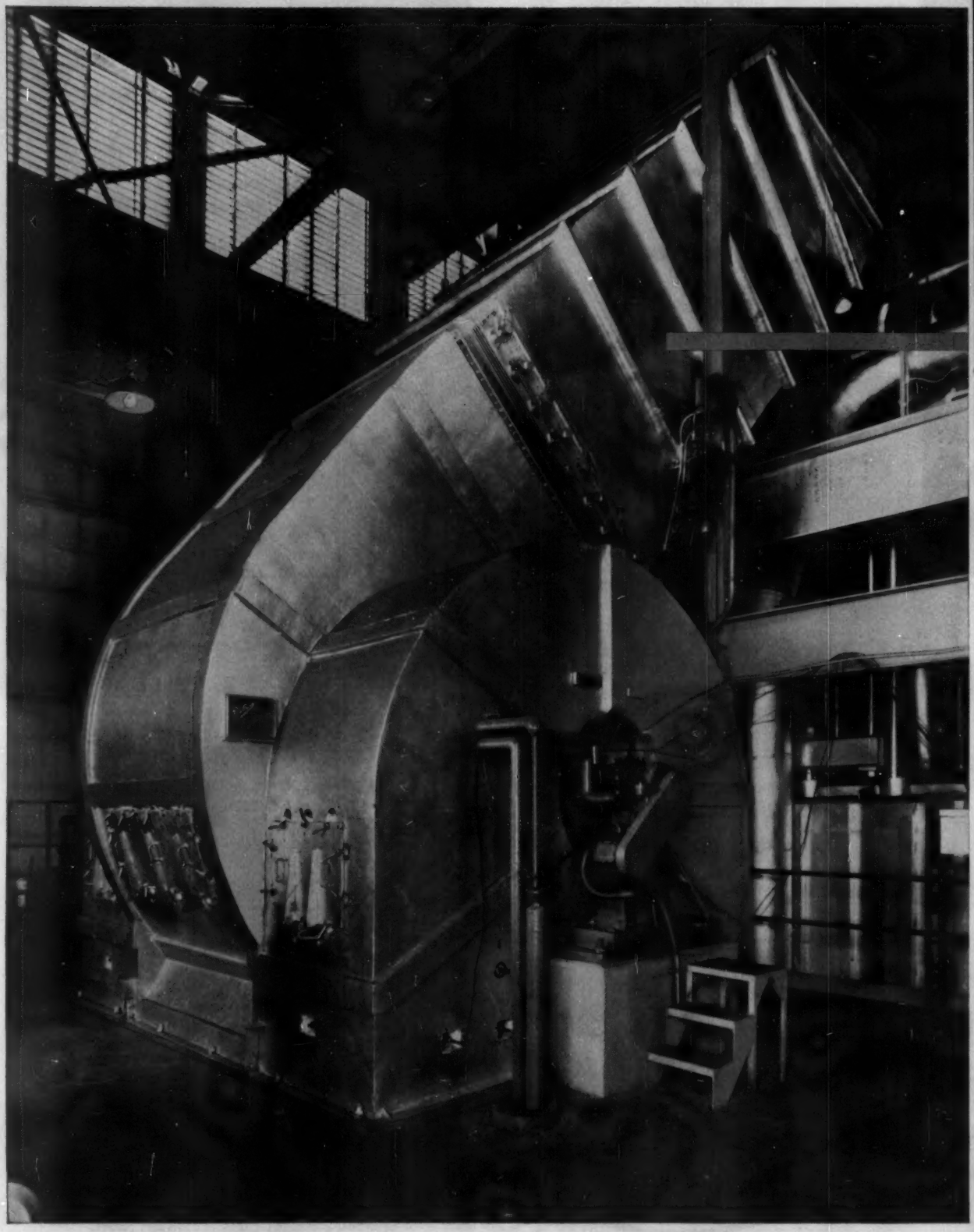
Sangamo builds its proven 200 ampere meter as the Class 200, 30 Ampere J2S Meter—with proven accuracy to 200 amperes, lower disk speed, high starting torque, low starting watts.

Make this *proven* Class 200 Meter first choice to measure your ever growing needs. For further information and prices, contact your nearest Sangamo Representative, or write us.

JH57-7

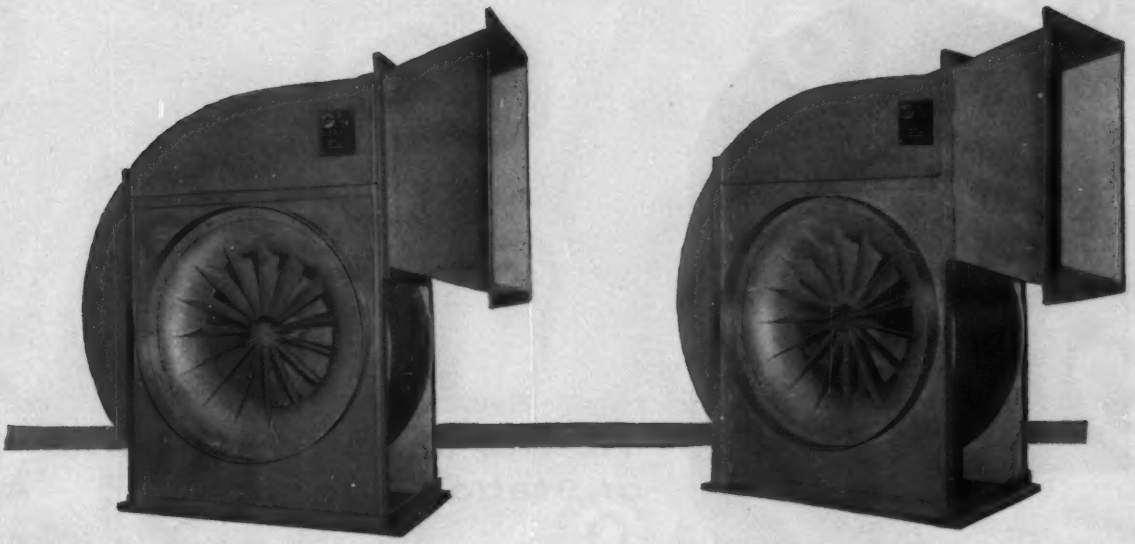
SANGAMO
Electric Company

SPRINGFIELD, ILLINOIS



"BUFFALO" DOUBLE-WIDTH I.D. FAN *in station of one of the largest utility companies. Here, "Buffalo" backward-curve blade design provided the desired balance of high efficiency and long life over the range of boiler loads.*

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT



The "Buffalo" Type "BLH" Fan—broad performance characteristics—86% mechanical efficiency.

The "Buffalo" Type "BA" Airfoil Fan — mechanical efficiencies up to 92%.

TO MATCH YOUR HORSEPOWER EVALUATION EXACTLY-

a complete series of "Buffalo" I.D. fans

Today's steam generation requirements are so varied and critical that no single type of mechanical draft fan can cover them all to best advantage. However, thanks to the complete "Buffalo" *series* of Fans, you can match fan characteristics to your requirements very closely.

Suppose maximum **efficiency at specific operating conditions is the major consideration.** The "Buffalo" Airfoil Fan, with mechanical efficiency up to 92%, would be the ideal choice, with 3 airfoil wheels and 3 semi-airfoil wheels available for best performance against the pressure of your particular system and load range. And dampered performance of the "Buffalo" Airfoil Fan is excellent, thanks to properly shaped and streamlined "Buffalo" Variable Inlet Vanes.

For systems where high efficiency over a broad operating range is of major importance, "Buffalo" Type "BLH" Fans offer stable performance and mechanical efficiency above 80% from 70% to 135% of rated volume. The "BLH" will operate at practically identical efficiency with either fixed or variable inlet vanes, for accurate volume without sacrificing fan performance.

Or where abrasive conditions exist, and where high-pressure, high-capacity characteristics could mean selection of a smaller (and lower-cost) fan, the "Buffalo" Type "CR" Radial Blade design merits your consideration. Besides inherent resistance to wear, it offers 76% static efficiency — plus a choice of three wheels for best performance under your pressures.

Write for Bulletins F-200, FD-205 and FD-106 for the one *complete* selection of Mechanical Draft Fans — "Buffalo" — known for the "Q" Factor, or *built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

How to improve heat-rate of Station "A"?

ASSUMING LOADS AND PEAKS are increasing or that the boiler will soon be derated . . .

An improvement of 5 to 6% in the over-all heat rate might very easily be accomplished by combining a Westinghouse gas turbine-generator with an existing steam turbine-generator, using the gas turbine exhaust for:

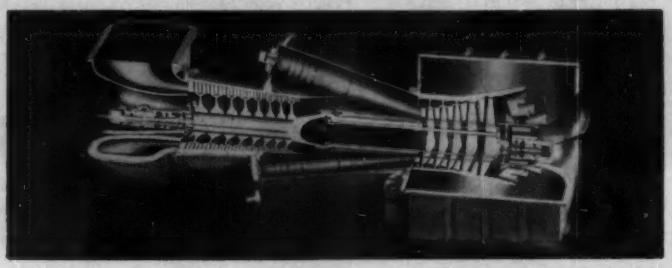
heating feedwater . . . to take the extraction drain off the steam turbine, increasing its capacity without adding to the boiler load.

combustion air . . . the gas turbine exhaust can be used as highly preheated combustion air to promote the efficiency of a steam boiler.

generating steam . . . the turbine exhaust can be used in a recovery boiler to generate steam for a low-pressure turbine.

Challenge us to show you how a modern gas turbine might be the economical solution to the demand for greater generating capacity or increased operating efficiency. Contact your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50596

YOU CAN BE SURE...IF IT'S Westinghouse



PROVING INSULATOR LIFE BY MAKING 'EM LIVE!

Prolonged, carefully-watched exposure takes guesswork out of O-B Insulator Design

There's only one way to know, for sure, what an insulator will look like after many years' exposure – wait that long! Accelerated tests give comparisons and a few quick answers. But, there's no substitute for knowledge gained the slow, hard way.

Summer and winter, year after year, every popular type and shape of insulator has been put on test in the O-B outdoor laboratory. Some never got past the trial stage but are still running for the data they may yield. All are energized, and exposed to severe contamination. Each specimen is connected to its own set of continuous-recording instruments to chart its constant behavior. In this way O-B takes the guesswork out of design.

Painstaking pursuit of fundamental insulator knowledge doesn't show on the surface of O-B products, or on the price tag. But the elements that prove to give better or longer service also give better and longer return on the invested dollar. This is the tangible value of Technical Competence – the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

* TECHNICAL COMPETENCE the heart of every *Ohio Brass* insulator

4821-H

here's a fuse link that clears faults itself

especially needed for high interrupting capacity cutouts at 12 kv and above

In years past, distribution at 4 kv and below was the rule, and the faults were low. The interruption of short-circuit current was relatively easy, not only because the circuit voltage was low but because the maximum duty imposed on a distribution cutout was low enough to permit the use of small bore fuse tubes. And these small bore tubes gave fairly sure circuit interruption over the entire fault current range.

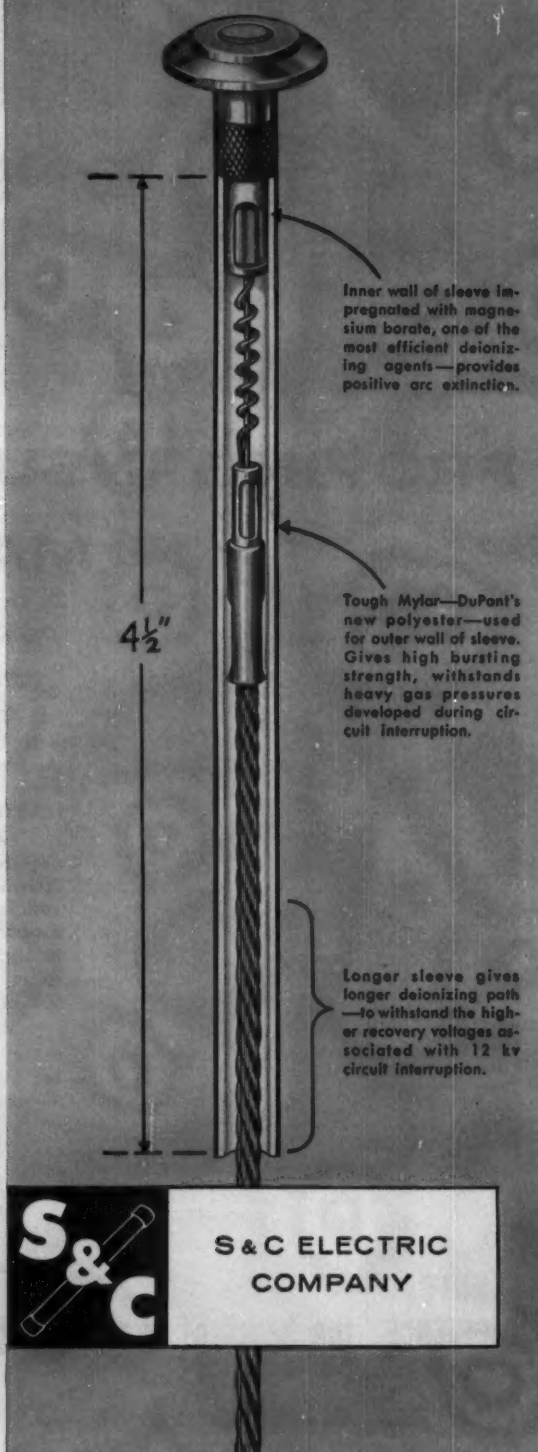
Today, circuit interruption is a lot tougher. Because of the high short-circuit currents, cutout manufacturers have increased, or should increase, the fuse tube bore diameter to minimize blast violence and to retain single-vented operation with its inherently safer *exhaust* behavior. And yet, when fused with conventional fuse links, such large bore cutouts can't reliably interrupt low-to-medium faults.

The result has been that the user has had to choose between: (1) A large bore cutout that couldn't positively clear the lower faults, hence requiring a momentary feeder outage by putting this duty on the back-up recloser and breaker while the cutout dropped open to isolate the fault, or (2) a small bore double-vented cutout that is inherently dangerous.

This new S&C Positrol Fuse Link makes the choice easy and obvious. By itself—and regardless of cutout design—it gives positive interruption of low and intermediate faults. With fault currents of 800 amperes and lower, this S&C Fuse Link acts positively as a dependable interrupting device at 12 kv. The illustration shows why.

Of course, at higher faults, the cutout takes over the interrupting duty.

S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.


4½"
Inner wall of sleeve impregnated with magnesium borate, one of the most efficient deionizing agents—provides positive arc extinction.
Tough Mylar—DuPont's new polyester—used for outer wall of sleeve. Gives high bursting strength, withstands heavy gas pressures developed during circuit interruption.
Longer sleeve gives longer deionizing path—to withstand the higher recovery voltages associated with 12 kv circuit interruption.

S&C ELECTRIC COMPANY

NEWS-SCOPE

FUTURE NEWS ▶ **Strong contender for the remaining TVA board vacancy** is Frank J. Welch, Democrat, and dean of Kentucky University's college of agriculture and home economics. Washington sources predict his nomination within the week. He'd succeed the late Dr R. Paty.

A drop in aluminum prices may be forthcoming in the near future. If so, aluminum would join other metals—copper, lead, and zinc—as victims of the growing government tendency to discontinue stockpiling and other price-supporting practices.

LATE NEWS ▶ **A proposal that distributors buy the TVA power system** has drawn fire from Citizens for TVA. New York promoter Walter Von Tresckow predicted eventual acceptance of his plan. However, Citizens for TVA, which is pushing a self-financing bill, tags Tresckow "an agent without principle," and says his plan has aroused "little interest" in the valley.

Plans for underwriting the 775,000-kw Rocky Reach dam on the Columbia River near Wenatchee, Wash., are in the works. The Aluminum Co of America and Puget Sound Power & Light Co have already agreed to help underwrite the dam through power purchases, and three other utilities are good prospects. The Chelan County PUD can cancel its $52,413,078 contract if financing isn't completed by Dec. 20. The project would involve a $250-million bond issue, and is scheduled for completion in 1962.

Government testimony bolsters Mississippi Valley Generating Co's $1.9-million claim against the government arising from the AEC-MVGC power plant contract, company attorneys feel. AEC Deputy General Manager Richard W. Cook said Adolphe Wenzell took no part in contract negotiations.

A 55-0 vote against unionizing was cast in a NLRB election by employees of Ohio Edison's Niles power plant when they rejected affiliation with the Utility Workers Union of America recently.

Yankee Atomic Electric Co has won an AEC permit to build a 134,000-kw, $57 million pressurized water reactor near Rowe, Mass. The permit is conditional on proof of financial ability to build the plant and more information on safety features.

Two New York State utilities have agreed to merge. Rockland Light & Power Co and Orange & Rockland Electric Co would combine to become Orange & Rockland Utilities, Inc. Rockland Light stockholders would receive one share for each share they own, while Orange & Rockland stockholders would get three and three-fourths shares for each share.

Congratulations . . . Combustion Engineering, Inc, elects H. G. Ebdon president . . . Rochester Gas & Electric makes Robert Ginna board chairman and chief executive officer, Ernest J. Howe president, Leo H. East executive VP, and H. S. Weatherby secretary.

ELECTRICAL WEEK

A TWO-MINUTE

ATOMIC PROGRESS ▸ **Tritium production may be a key to the Windscale accident.** Deuterium was being irradiated in the pile under high pressure to produce tritium for Harwell thermonuclear experiments. When the temperature went up, the containers burst, creating an explosion and melting aluminum cladding from uranium elements. Result: Oxidized uranium fumed up the chimney (p 53).

EVENTS ▸ **By investing in tailored weather forecasting services** and understanding their limitations, utilities can trim costs (p 52).

MEETINGS ▸ **If utilities want heat pump loads, they'd better do their own selling,** a manufacturer says, because utilities stand to make the biggest profit. And now is the time to push—for several reasons (p 84).

AEIC hears about Connecticut's coordinated capacity plan, sample testing of watthour meters, a slowdown of "generation progress," declining practice of submetering and resale, and strong chance that shifting peak load patterns means more investment per revenue dollar (p 58).

Inflation soon may halt the traditional effort of electric utilities to hold down rates; thermal gains are slowing down to about 1% a year and equipment prices are climbing, Rocky Mountain Electrical League is told (p 57).

SYSTEM PLANNING ▸ **System var supply should be planned far ahead,** sometimes five years or more. This article, from Union Electric Co, gives a step-by-step description of such planning (p 68).

TRANSMISSION ▸ **Connecting pipe-type and oil-filled cable** with a new stop-joint cut outage time on the existing oil-filled runs avoided difficult underground installation, and simplified the oil supply system. Fitting six joints took only five days. They connect three oil-filled 69-kv, 1,500-Mcm copper, paper-insulated, lead-sheathed cables in fibre-concrete ducts with a 69-kv pipe cable of 1,500-Mcm copper conductors, paper insulated, in 6⅝-in. pipe with somastic coating (p 61).

DISTRIBUTION ▸ **Three especially thorny problems complicate supplying industrial** power: Voltage dip, lamp flicker, and harmonic resonance. The author discusses these problems on p 63.

Night repairs are easier, thanks to a light adapted from an ordinary 20,000-lumen mercury vapor street lamp. Mounted vertically on steel legs, it throws light 60 ft into the air, and illuminates a wide ground area (p 76).

INDUSTRIAL ▸ **Modernizing with electric equipment boosted production 90%** at a rock quarry (p 88).

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

METERING ▶ **Here's a slick way to find out how much power is being used** by customers' water heaters, dryers, and the like: Mount a test meter on a board and hang it next to the appliance's circuit switch. Hook the meter into the appliance switchbox by using dummy fuses to which meter leads are attached. This obviates disturbing the customer's wiring (p 75).

SELLING ▶ **Individualized service helps boost residential consumption** in a public power district 385 kwhr above the national annual average. The salesman supplies complete plans and a scale model (p 80).

HEATING ▶ **Utilities can serve random space-heating loads** with controlled blocks of energy, tests of three accumulator-type storage systems indicate. Over a 20 year period one office building installation consumed an average 0.328 kwhr per degree day per 1,000 cu ft. A storage and finned coil and blower radiation system heated a one story, two bedroom house in January (p 66).

ECONOMICS ▶ **Electric utilities emerge as the big off-set** in the softening business investment picture, McGraw-Hill's 1958 Investment Survey reveals this week. While business plans an overall 7% cut in '58, investor-owned electric utilities are set to hike up '58 outlays by 8% over this year's record $4 billion. Still, this marks a leveling off. For in '57, utility investment took a 30% leap. And in their spending plans for '59, 45% of the electric companies foresee a slackening off from next year's spending (p 127).

FINANCE ▶ **Utilities may have to reverse the downward electricity price trend** because savings in fuel consumption and power plant first costs are leveling off, and equipment costs are rising (p 130).

PEOPLE ▶ **To fill future management ranks,** utilities must cultivate promising young men, says Daniel Edgar Stultz, new Potomac Edison Co president (p 54).

Alabama Power Co elects D. D. Wendel vice president; Benjamin Electric Mfg. Co makes A. E. Swedenborg vice president of sales (p 116).

MANUFACTURERS ▶ **A 42,500-sq ft condenser, largest ever shipped in one piece** by Allis-Chalmers, heads for California Electric Power Co . . . Babcock & Wilcox will furnish the boiler for western Pennsylvania's biggest (172,000) turbine generator (p 107).

NEW EQUIPMENT ▶ **Street lighting control uses cadmium selenide photocell** in place of tubes, transistors, or magnetic load relay. . . Compact lightning arresters for direct mounting on transformers and other substation equipment are available in type F ratings of 20 to 73 kv (p 92).

ENGINEERING TRENDS

Polythene-insulated or solid paper insulated cable may be used for the 200-kv dc interconnection between France and England. The cable will probably operate at 100 kv above and below ground potential.

The present trend in nuclear fuel technology is strongly in the direction of constructing fuel elements of oxides of fertile and fissionable materials. Lower density of oxide material may pose a problem of operating reactivity but oxides have good radiation damage resistance and compatibility with hot water.

Poor flow performance of some conventional storage bins is due to a central core movement responsible for "rat holes" and high pressures on coal which cause its adhesion to the hopper walls. Experiments show that a 75-deg sloped hopper and an inverted core of stainless steel will eliminate the central core and provide an environment of low, steady pressure on the hopper walls.

Homogeneity of rotor forgings can be improved by changing from acid to basic steel-making practice, thereby reducing the amount of the undesirable elements, sulphur and phosphorous. However, basic electric-furnace steels contain more hydrogen which tends to cause flaking during processing of the forging.

Freezing water has been successfully used for reactor maintenance. Engineers of Argonne National Laboratory have used it as a radioactive shield in repairs made to the Laboratory's Experimental Boiling Water Reactor.

Niobium, a little-known and little-used element, seems about to emerge as a valuable structural metal of the future. Recent research indicates that it offers excellent promise as a structural metal at temperatures above 1,800F. Niobium does not lose its room-temperature strength drastically with increasing temperature. At 2,000F — just about the melting point of copper — it has roughly the same strength as molybdenum and is several times stronger than the best available nickel-base and cobalt-base alloys at this temperature.

FROM EDITORS IN THE FIELD

Optimum size crew including foreman is five to nine men, depending on the location and work load according to a cost study by a Southeastern utility. Four such crews are the maximum that should be operated from a single crew headquarters.

A series of galloping-conductor tests on ball-and-socket insulators has proved to Northern States Power that modern suspension insulators will withstand severe mechanical duty far beyond that for which they are designed.

Before you start that deadend, stop and re-consider. Let's look at a few facts. In 1946, the average residential use of electric power was 1,329 kwhr. In 1956, it was estimated at 2,980. Use had more than doubled in ten years.

What can you expect the next ten years to bring? Already the experts are forecasting 6000 kwhr annual consumption by 1965, 8000 by 1970. Past experience indicates the experts aren't so "expert." They usually estimate on the low side.

What's the point? You may have to increase the capacity of that line in five years, probably for sure in ten years. The easiest way to increase capacity is to raise voltage—provided you have the necessary insulation. As long as you're going up on the pole anyway, why not put in three insulators? It's a lot cheaper to do it now.

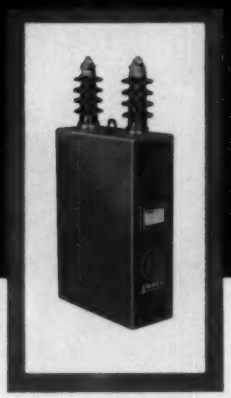
The insulators to use are O-B, of course.

Ohio Brass

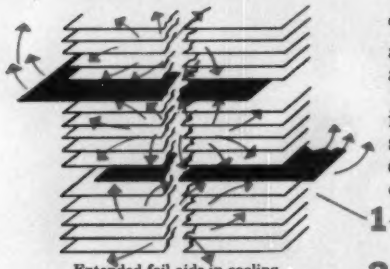
MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD.
NIAGARA FALLS, ONT.

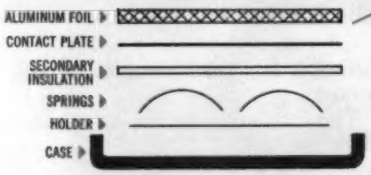
BECAUSE THE FOIL EXTENDS HERE



VAREX users get



Extended foil aids in cooling



The extended foil design in Varex capacitor provides the aluminum foil with extra duties, beyond its conventional role as an electrode.

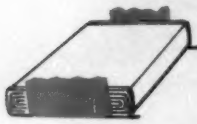
Varex foil helps in cooling, in reducing current densities, in simplifying the electrical contact system. In fact, you can see at least six basic advantages that can be attributed to the extended foil, advantages that contribute directly to longer capacitor life.

1—Extension of foil provides an unobstructed path for heat to flow from center to end of element.

2—Extended foil makes possible a simple contact system whereby a contact plate can be pressed against the end of the element by springs . . . no welding, soldering or crimping.

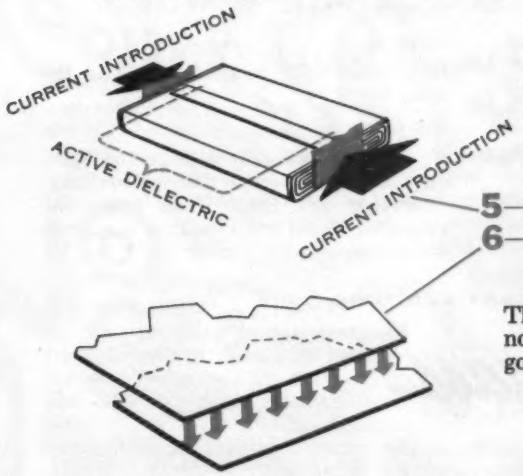
3—With contact at two points on each turn of foil, the length of current path along the foil is short.

4—Current density on the foil is reduced since each contact feeds a shorter length of condenser surface. (The strip running across the bottom of this page represents one aluminum foil in a Varex element, drawn to scale and



4" — Orange indicates contact area between plate and foil

six extra benefits



Only stress is edge to plane, not edge to edge

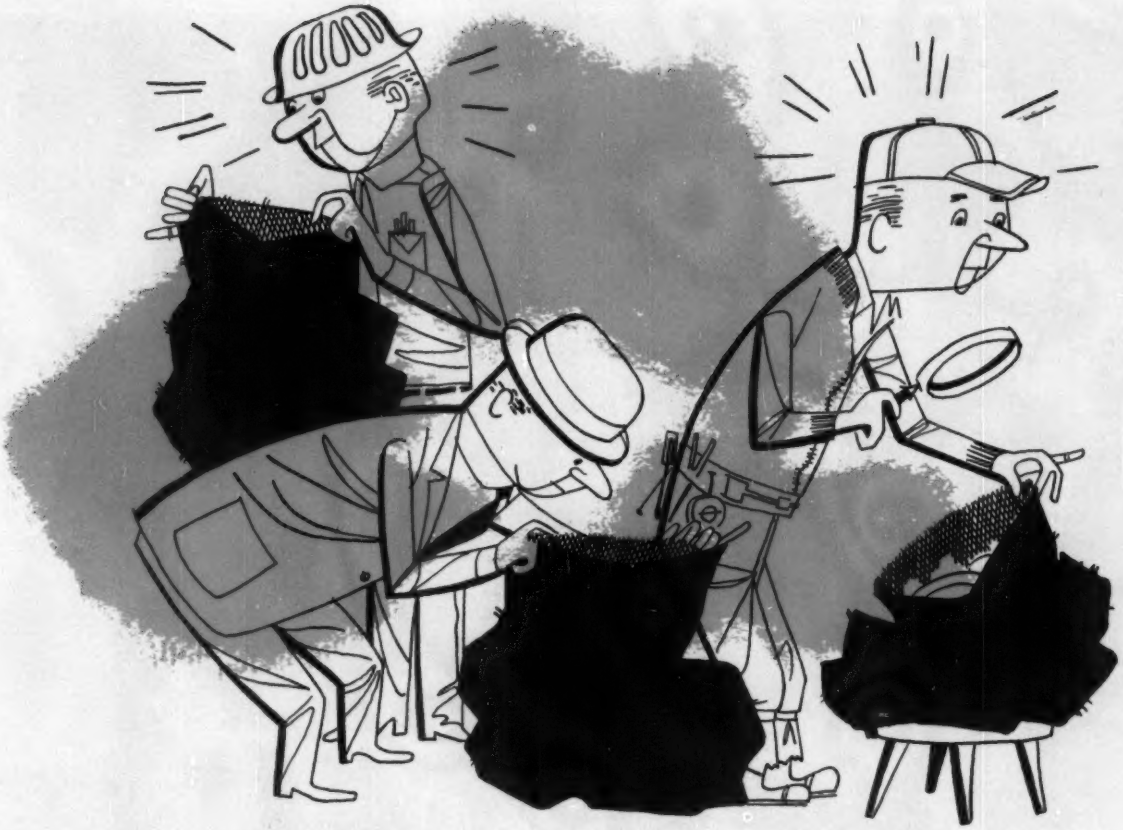
partially unwound. Fully unwound a foil is approximately 900 inches long. The broken orange line indicates the portion of the foil edge which is contacted by the plate. More than half of the foil length is in contact with the plate. With so many contact areas, each area feeds only a short length of condenser surface.)

5—Current is introduced in an area outside the active dielectric.

6—Opportunity for concentrated electrical stress is reduced since stresses are always those of a foil edge to a foil plane. There are no edge-to-edge stresses.

The advantages of extended foil show that all capacitors are not alike. Only Varex has extended foil and the benefits that go with it.

Ohio Brass



Mystery: Why no O-B insulators in the three gunny sacks?

Scene: A power company warehouse in South Dakota.

Time: Midsummer 1956.

Cast: Safety engineer, linemen, Graybar salesman.

Action: Group assembled to discuss hot-line practices and treatment for shock resulting from handling defective materials. Among items on display were three gunny sacks full of insulators with pinhole cracks and other defects.

Question: How many brands of insulators were represented?

Answer: Several.

Question: How many O-B insulators were in the three bags?

Answer: Not one.

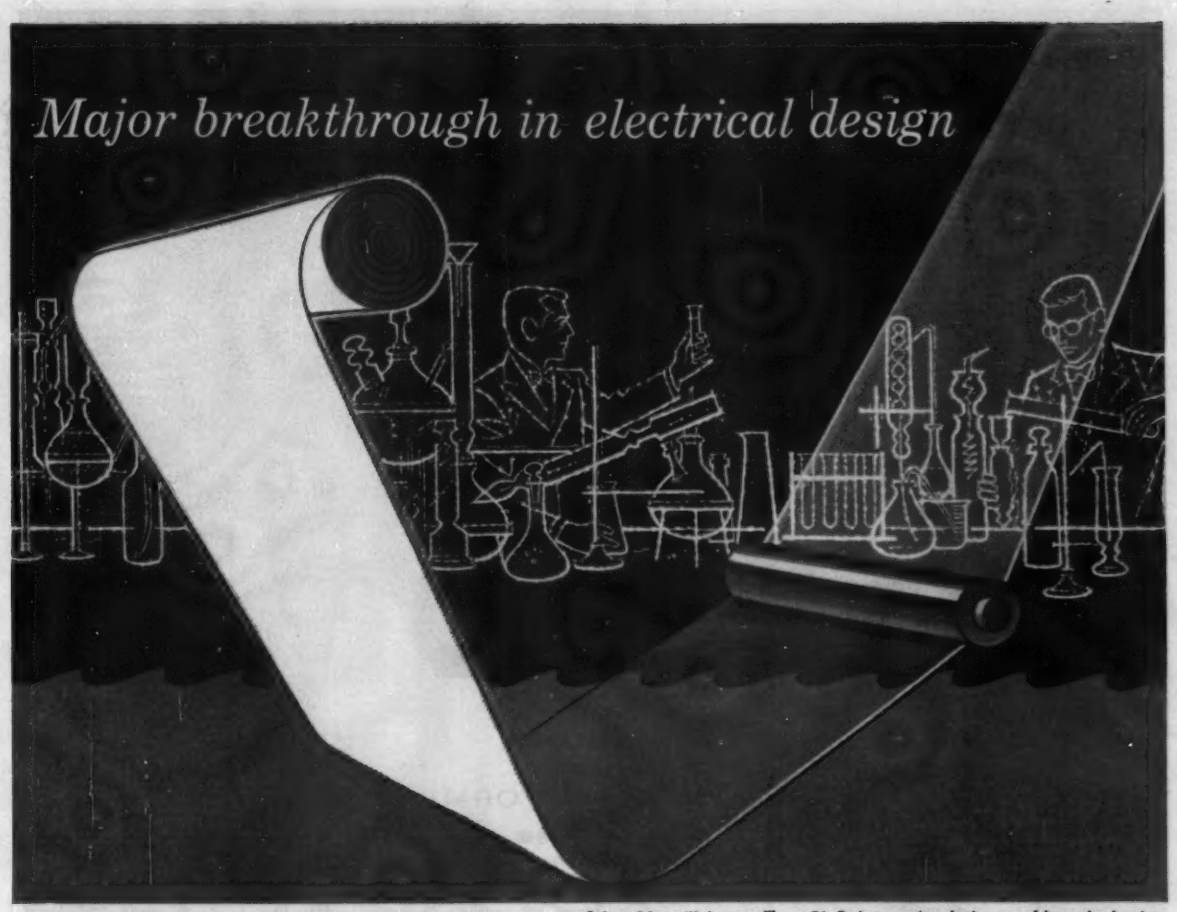
Solution: If you want insulators with proved lightning immunity on your distribution lines, always specify Ohio Brass insulators, available from your nearby Graybar warehouse.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

Distributed by GraybaR ELECTRIC COMPANY

4769-H



Johns-Manville's new Type 71 Quinterra insulation combines the lasting dielectric strength of the purified asbestos base sheet and epoxy varnish.

For smaller Class B equipment . . .

New J-M Type 71 Quinterra® Epoxy-treated to double dielectric strength

Johns-Manville now opens up a new era in electrical design, with Type 71 Quinterra—the epoxy and asbestos insulation that breaks through today's limitations on ratings and size—offers untold new possibilities in compact class B equipment.

Offers 5 major improvements

1. High Epoxy Content (approx. 45% to 50%) provides the optimum electrical benefits of these high-dielectric resins and asbestos. This mechanically and electrically strong insulation combines the lasting inherent dielectric strength of the Quinterra base sheet with the excellent electrical properties of epoxy varnish.

2. Over 700 Volts/Mil is the tested and proved dielectric strength of Johns-Manville's new Type 71 Quinterra insulation. This exceptionally high characteristic offers brand-new opportunities in increased power from smaller frames—with less metal.

3. Continuous Operation to 175C with no reduction of properties brings Quinterra Type 71 well above the standard class B limit of 130C. At 175C, this new insulation exhibits a dielectric strength *well above its 700 volt per mil minimum.*

4. Moisture Absorption Less than 2%. Quinterra Type 71 resists humidity conditions that would break down other insulations. Even at high relative humidities, this new insulation exhibits its unusually high dielectric strength!

5. Improved handling characteristics make Type 71 Quinterra ideal for today's assembly techniques. Its flexibility lets it adapt to the reduced radii of smaller equipment.

Also new Type 72 Quinterra for less rigid requirements

Type 72 Quinterra (approx. 20%-30% epoxy content) offers high dielectric strength at considerable savings.

FOR a complete specification sheet and samples of the new epoxy-treated Quinterra, write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

Johns-Manville ELECTRICAL INSULATIONS

PREFORMED ARMOR RODS
increase uninterrupted service life of conductor

The wind blows, the conductor vibrates and the life of your line is at stake. If the vibration problem is such that severe frequency and amplitude conditions are sufficiently prolonged, the conductor could begin to break regardless of the protective armor used. And, if the conductor begins to break, PLP Preformed Armor Rods have a big advantage over other armor: The rods undertake the function of an electrical and mechanical repair splice.

All armor rods greatly reduce vibration stresses, but if vibration is severe enough to cause strand breaks, other types will not prevent parting of the strands. With PLP (short pitch) Preformed Armor Rods, it's a different story; the conductor is held tightly and uniformly throughout the entire length of the rods—not at one point. You have a long, firm grip that never relaxes, that maintains conductivity in spite of the break. Thus, your line continues to function unimpaired.

There is one other Preformed advantage to keep in mind. Some types of armor require the use of bolted end-clamps that can shake loose and cause chafing. Preformed Armor Rods require no end-clamps.

For a long uninterrupted service life, Preformed Armor Rods are the best suit of armor your conductor can wear. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . In 10 years the leading manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

PLP

You can look up to **Preformed**

Made in accordance with one or more of the following U. S. Patent Nos. 2,609,653; 2,275,019 and 2,587,521. Other patents pending.

New Westinghouse
10 Kvar Capacitor

ADDING 10 KVAR SECONDARY CAPACITORS NOW EASIER THAN EVER

Westinghouse offers a new 10 kvar type FPS capacitor to improve power factor on single phase, 60 cycle, 240 volt secondary systems. Here is a compact, light-weight package that is as safe and easy to install as the smaller 3, 5 and 7½ kvar capacitors which Westinghouse pioneered.

First, the top hanger is fastened to the pole with a lag screw . . . the capacitor with the lower hanger attached is then hung and the lower hanger lagged to the pole. Then simply connect the line leads and the Westinghouse capacitor begins to pay off in increased load capacity, reduced load losses and improved voltage level.

Once you've hung Westinghouse capacitors you can forget them. Thousands of installations have proven the effective seal used with the porcelain bushings. And the lifetime finish of heavy metallic zinc protects outdoor installations indefinitely from weather, rust, corrosion and abrasion.

For detailed information call your Westinghouse sales engineer. J-60930

YOU CAN BE SURE...IF IT'S

Westinghouse

When the weather's bad you can say . . .

today's the day to work on Shelterfor-M*

Extensive floor space inside the shelter area allows crewmen to pass two breakers past one another.

Cold, rain, snow or sleet . . . your crews can work *inside* on *outdoor* switchgear when you have Westinghouse Shelterfor-M. No longer is it necessary to hang canvas tarps and build make-shift shelters to work on breakers, instruments or relays when the weather is bad. In fact, maintenance men *use* the wet weather to work in the new Westinghouse metalclad switchgear . . . and save the pleasant days for the regular exposed-to-weather installations.

Roomy interior of the Shelterfor-M switchgear allows instrument panels to swing wide for front drawout of breakers for inspection and testing. Two breakers can be passed, side-by-side, even with the doors open wide, inside the covered passage-way.

You also get the many outstanding features of standard Westinghouse switchgear: undercoating, multicoat painting and Bonderized finishing, to eliminate rust and corrosion. Exclusive Redarta® flame retardant insulation. Jig-welding construction for interchangeability of like-rated breakers.

For complete information call your local Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60924

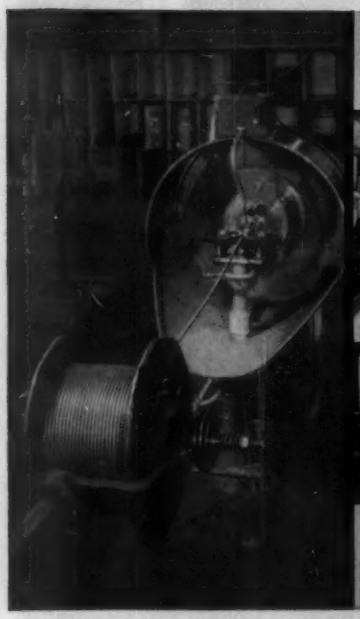
*Shelterfor-M . . . shelter for maintenance

YOU CAN BE SURE...IF IT'S Westinghouse

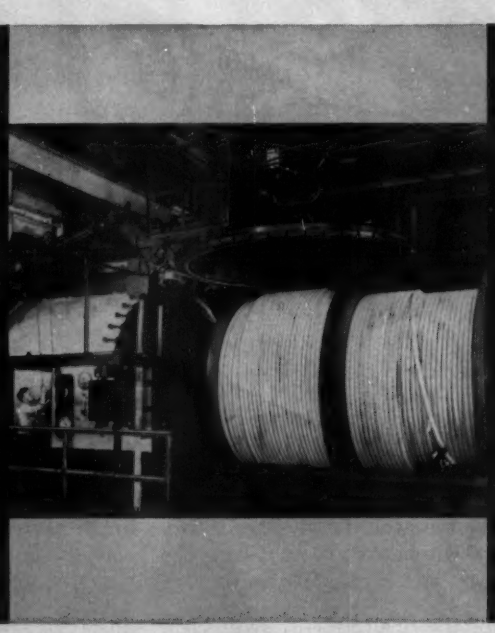
GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.



Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

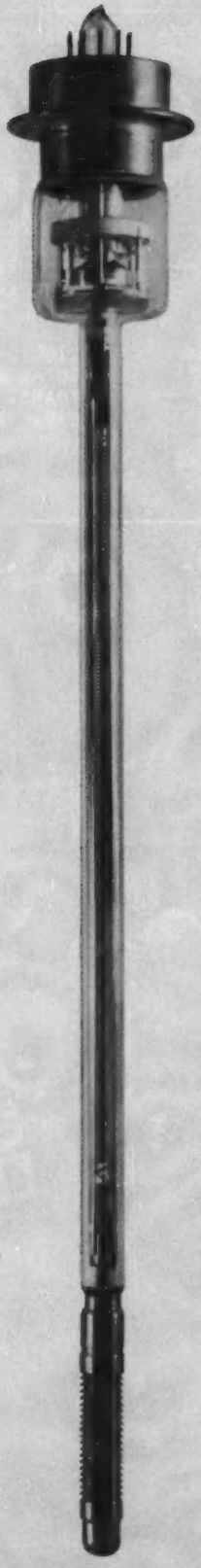
- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**



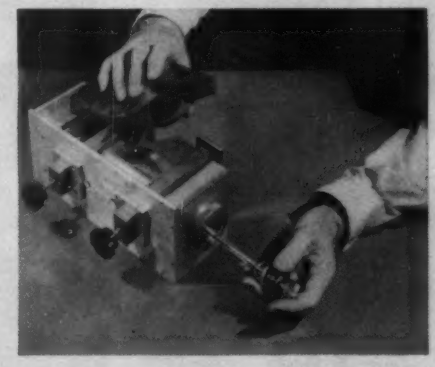
A GREAT AMPLIFIER TUBE IS PERFECTED FOR TELEPHONY

A new transcontinental microwave system capable of carrying four times as much information as any previous microwave system is under development at Bell Laboratories. A master key to this development is a new traveling-wave tube of large frequency bandwidth.

The traveling-wave amplifying principle was discovered in England by Dr. Rudolf Kompfner, who is now at Bell Laboratories; the fundamental theory was largely developed by Labs scientist Dr. John Pierce. Subsequently the tube has been utilized in various ways both here and abroad. At the Laboratories it has been perfected to meet the exacting performance standards of long distance telephony. And now for the first time a traveling-wave tube will go into large-scale production for use in our nation's telephone systems.

The new amplifier's tremendous bandwidth greatly simplifies the practical problem of operating and maintaining microwave communications. For example, in the proposed transcontinental system, as many as 16 different one-way radio channels will be used to transmit a capacity load of more than 11,000 conversations or 12 television programs and 2500 conversations. Formerly it would have been necessary to tune several amplifier tubes to match each channel. In contrast, a single traveling-wave tube can supply all the amplification needed for a channel. Tubes can be interchanged with only very minor adjustments.

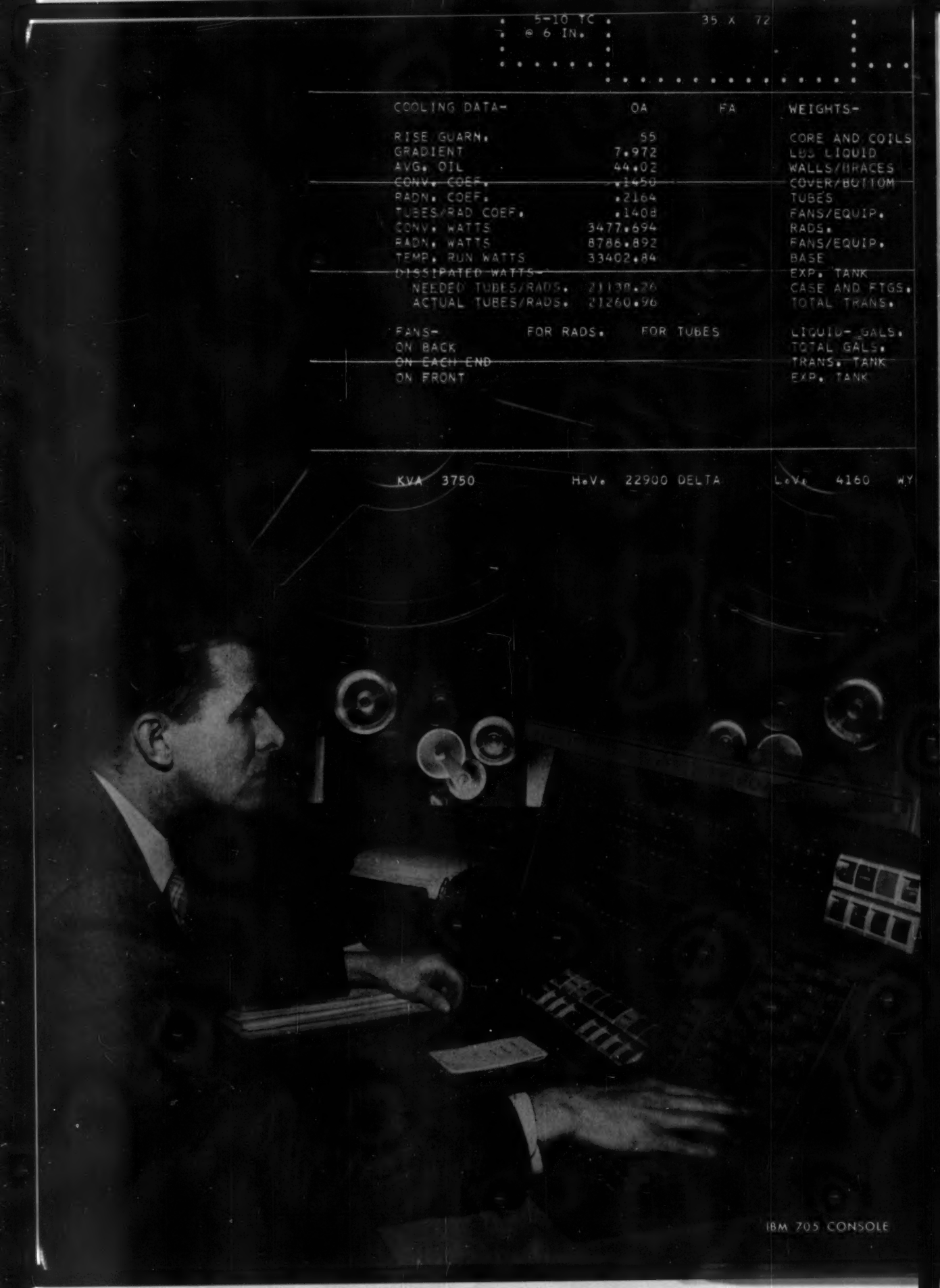
The new amplifier is another example of how Bell Laboratories research creates new devices and new systems for telephony.



Left: A traveling-wave tube. *Right:* Tube being placed in position between the permanent magnets which focus the electron beam. The tube supplies uniform and distortionless amplification of FM signals over a 500 Mc band. It will be used to deliver an output of five watts.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



IBM 705 CONSOLE

Helping the industry meet its growing loads

This machine advances tomorrow's developments

Time is of the essence to solve the intricate design and application problems consuming enormous amounts of engineers' time.

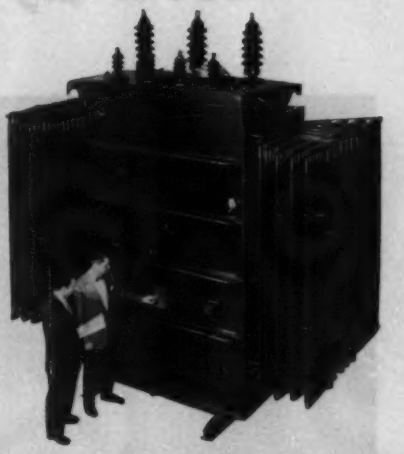
For this reason, Westinghouse has invested heavily in the design of power transformers by electronic computers. This automated designing is freeing dozens of engineers from millions upon millions of mechanical computations. As a result, Westinghouse creative design capacity and long-range development are greatly expanded. The result . . . creative engineering progress.

Look for new materials and years-ahead methods of construction from Westinghouse. This, combined with new ideas, will produce better products which can be translated into money savings for you. From pioneering ideas at Westinghouse, look for equipment that will help you keep the cost of electricity the consumer's biggest bargain.

J-97202

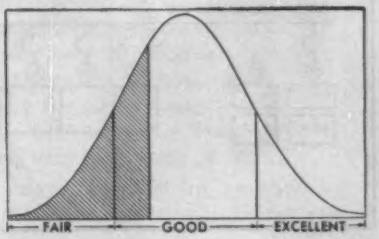
YOU CAN BE SURE...IF IT'S

Westinghouse



Designed with electronic computers

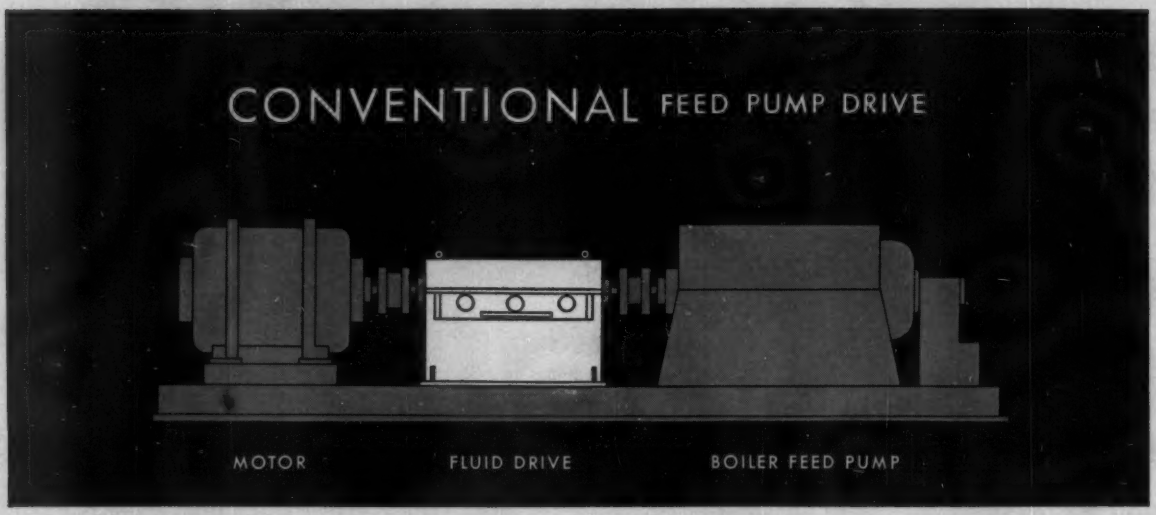
In addition to rating, complete performance data was loaded into the machine—impedance, iron loss, total loss, exciting current, temperature rise, sound level and many other variables. The computer made the necessary calculations of physical quantities and proportions of iron, copper and insulation. Tank dimensions, cooling requirements and other factors were all calculated to bring the design to optimum standards. Human error was eliminated.

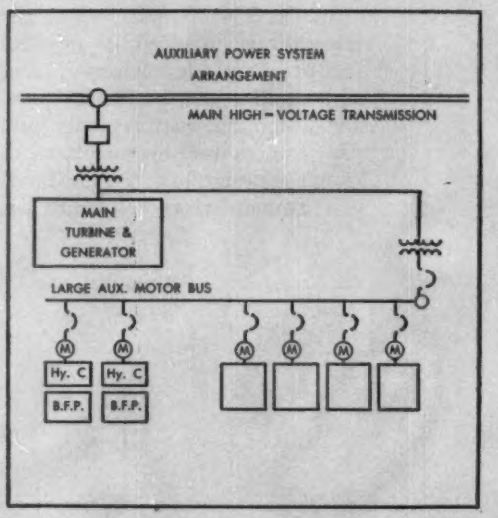


Distribution of design quality . . . shaded area is eliminated in computer design

Electronic computers have reduced transformer design time from two weeks to four minutes. Coupled with this is the machine's unusual genius of being able to produce optimum designs consistently . . . equal to designs of top engineers with unlimited time.

How Gýrol® Fluid Drive meets all

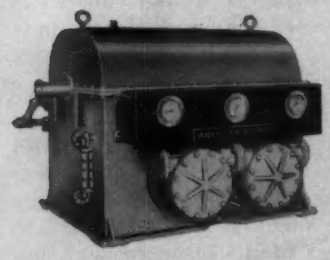




Of all power-plant auxiliaries, the boiler feed pump consumes the greatest single segment of invested power. To release more of this power to consumer lines, power plants of all sizes are controlling feed water flow by speed regulation through Gýrol Fluid Drive—driven by a constant speed prime mover.

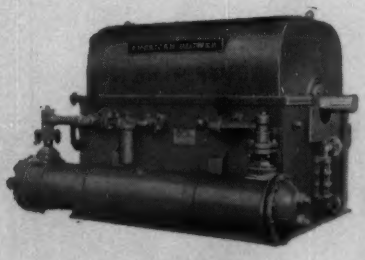
Gýrol Fluid Drive offers several specific advantages:

1. It saves power over the entire operating range by eliminating wasteful throttling by valves.
2. Fluid Drive's adjustable-speed feature permits reduction in pressure—resulting in further power savings.
3. It reduces wear on bearings, and other vital pump parts, by letting the pump operate at speeds that fit boiler demands.
4. With Fluid Drive, paralleling of pumps is simplified. Change-over from operating to standby pump is quick and easy.
5. Quiet operation is inherent in the design of Fluid Drive, since a "cushion of oil" is the means of energy transmission.



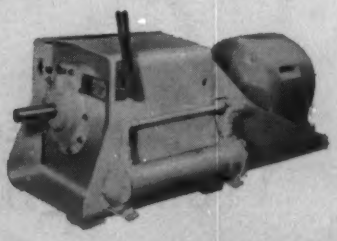
TYPE VS CLASS 6

- adjustable speed control
- 250 to 12,000 horsepower
- speeds to 3600 rpm



TYPE VS CLASS 4

- adjustable speed control
- 100 to 2500 horsepower
- speeds to 1800 rpm

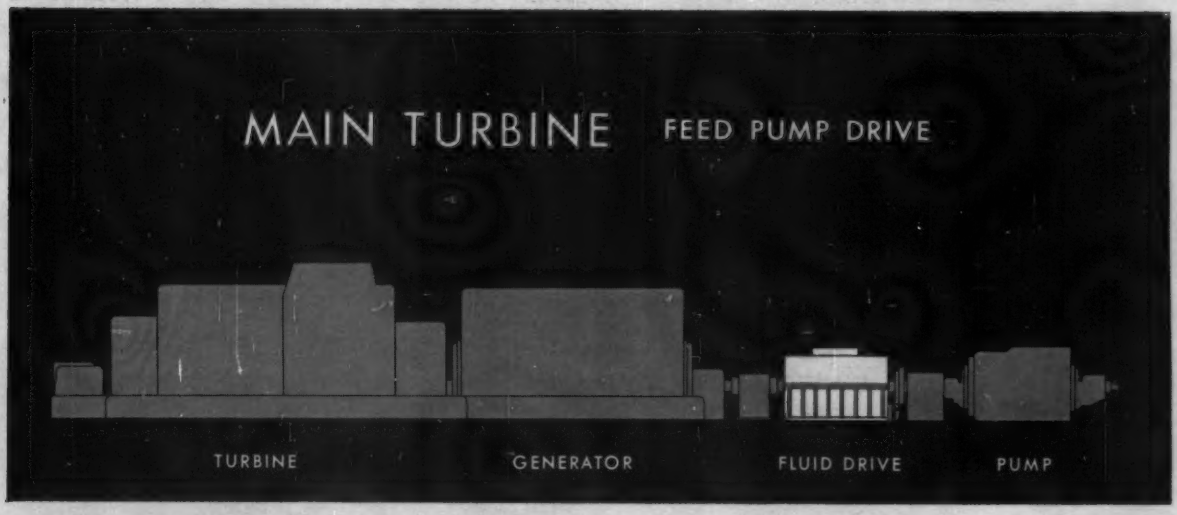


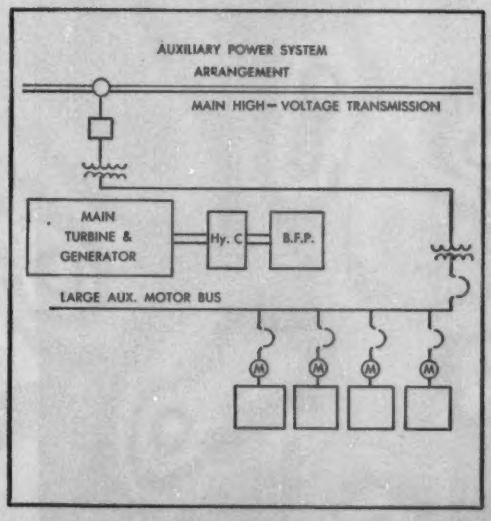
TYPE VS CLASS 2

- adjustable speed control
- 1 to 800 horsepower
- speeds to 1800 rpm

requirements for feed pump control

Regardless of station size, arrangement, or prime mover, you get the advantages of power savings, reduced pressures, and quiet operation with American Blower Gýrol Fluid Drives





Already in the construction stage is the use of Gýrol Fluid Drive for main turbine feed pump drives on some of the largest generating units yet projected.

For example, two of these stations will each drive, through a 12,000-hp adjustable-speed Gýrol Fluid Drive, the main feed pump from the high-pressure turbine. Full boiler capacities will be supplied by the single 5-stage pump, each delivering 6330 gpm against 6400 feet total discharge head when operating at 3510 rpm with feed water at 363° F.

Each pump requires an excess of 11,000 hp, and will be driven from the generator shaft through an adjustable-speed Gýrol Fluid Drive.

In your plans for expansion, why not discuss the advantages of Gýrol Fluid Drive with an American Blower engineer. His knowledge of this application in modern power plants may prove valuable to you. Call our nearest branch, or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of AMERICAN-Standard

I-T-E... Pioneer in

In 1936, I-T-E introduced the first 5 kv magnetic air circuit breaker and it has led the field in development of this type of equipment ever since. In the past 4 years alone, it has extended its line of 5 kv metal-clad switchgear to include the first 350 mva interrupting capacity air breaker and its line of 15 kv metal-clad switchgear to include the first 1000 mva air breaker.

Get complete information on all I-T-E high voltage magnetic air circuit breakers. Call our nearest sales office today for it. Or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

SWITCHGEAR DIVISION

I-T-E CIRCUIT BREAKER COMPANY

1936
First 5 kv air circuit breaker—100 mva

1938
Increased capacity to 150 mva

1950
Reached 250 mva rating

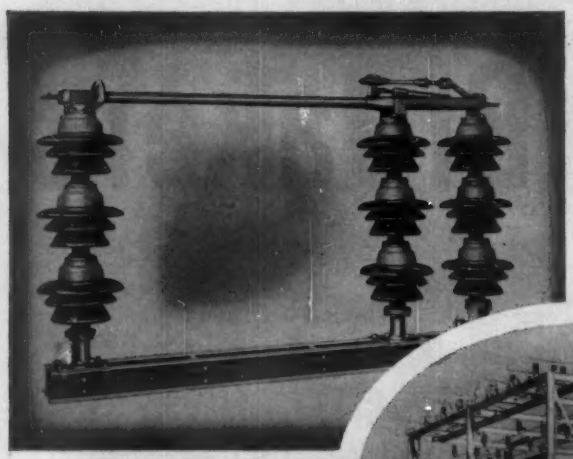
1954
Brought out 15 kv air circuit breaker

1956
350 mva in 5 kv class

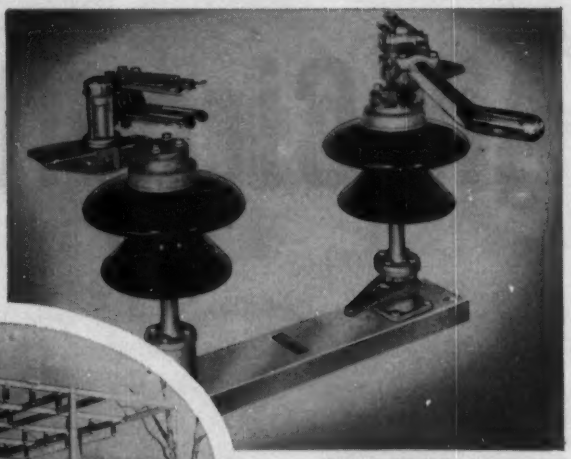
Air Circuit Breakers

1956
750 mva in 15 kv class

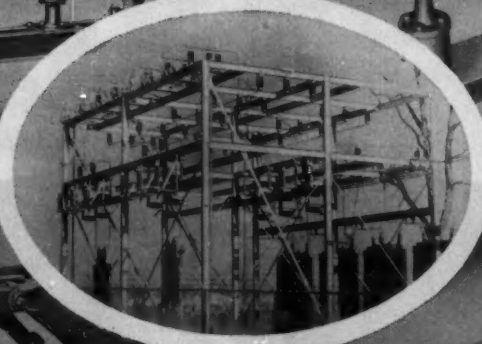
1957
Now the 1000 mva
15 kv circuit breaker



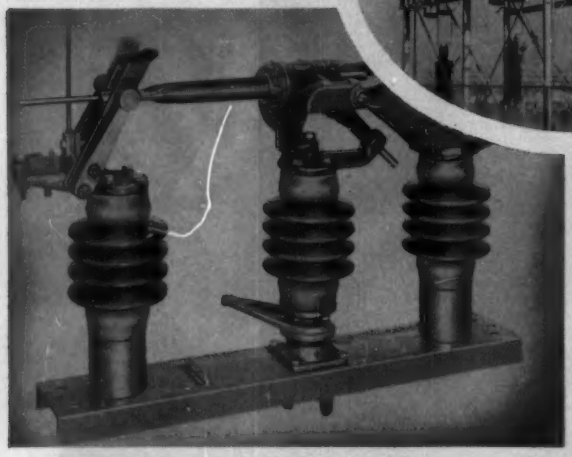
8400 VERTICAL BREAK SWITCH



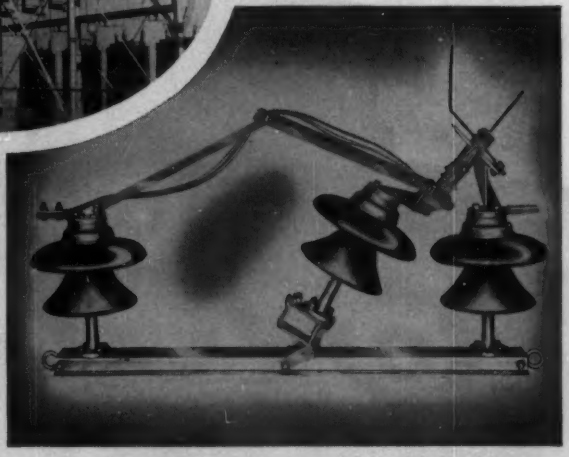
BF20 SIDE BREAK SWITCH



AF20 VERTICAL BREAK SWITCH WITH ROTATING BLADE



AG30 SELF-ALIGNING TILTING INSULATOR SWITCH



4 ways to solve outdoor switching problems

"Engineers" is our middle name . . . a company that has specialized for 47 years in one subject . . . high voltage switchgear.

When you specify a 3E switch your responsibility for safe, efficient power transmission is guarded by equipment *known* to be eminently practical, built to exceptionally high standards of construction and sensibly priced.

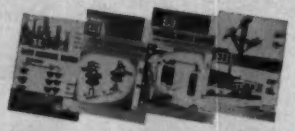
AF20 Vertical Break Switch with Rotating Blade that makes operation unusually easy. Ideal direct current path . . . designed for a minimum of contact points and thus a minimum of possible trouble points.

BF20 Side Break Switch with advanced features unusual for its low cost. High pressure braidless silver contacts . . . positive wiping and ice-breaking toggle motion.

AG30 Self-Aligning Tilting Insulator Switch . . . ideal for cross arm mounting. This economical switch is exceptionally easy to install and will align itself and operate regardless of pole's condition.

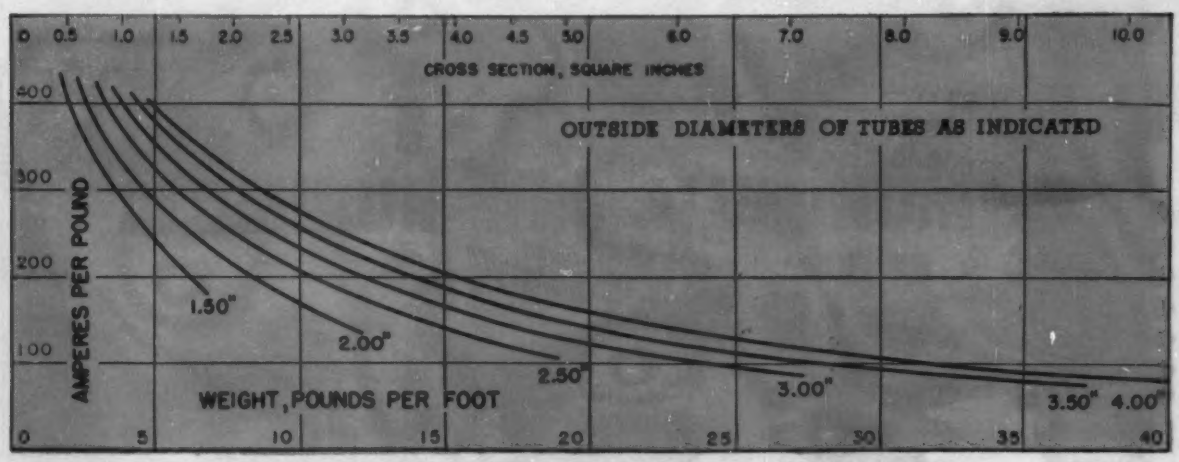
8400 Vertical Break Switch with direct line current path plus an almost effortless operation that greatly prolongs switch life and effectiveness. The ingenious, powerful toggle mechanism has made this switch the choice in systems up to 230Kv.

For full details . . . write for Bulletins;
8400 Vertical Break Switch, Bulletin 327
Side Break Switch (BF20), Bulletin 335
Vertical Break Switch (AF20), Bulletin 333
Self-Aligning Switch (AG30), Bulletin 323



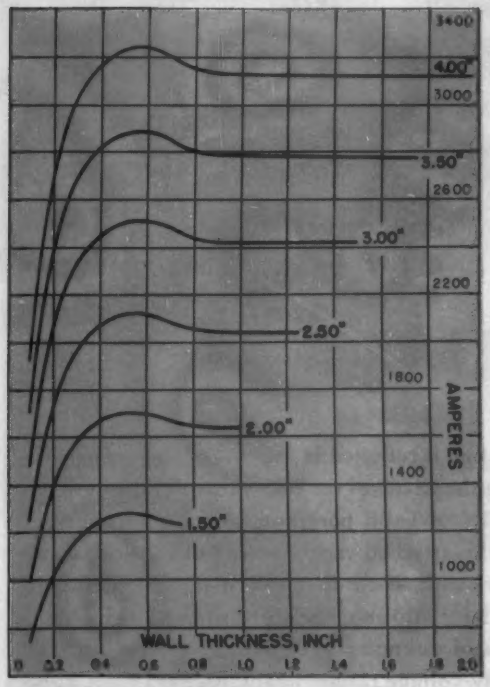
ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Ill.

3E



60-CYCLE CURRENT ratings of six round copper tubes in terms of weight per foot.

How to carry more amperes per pound of copper



THE INFLUENCE of wall thickness on the 60-cycle current rating of six round copper tubes.

THIN-WALL TUBES with low wall-thickness-to-diameter ratio offer decided electrical advantages—and opportunities for cutting bus costs—wherever mechanical requirements permit. The charts above and at the left show the 60-cycle skin-effect phenomenon characteristic of six representative sizes of round copper tube, 1.5" to 4.0" O.D. The curves cover the entire range of wall thickness from solid round rods, at the right, to the thin-walled tubes in common use at the left. What is true of round tubes is also true of other tubular bus shapes.

INSTALLATION ECONOMIES. When round tubular bus conductors can be selected in thin-wall sizes from the standard pipe dimension schedules, it is possible to effect further economies by the use of stock sizes of supports, connectors, tap clamps, and other necessary hardware available in great variety in dealers' stocks.

More complete information on tubular conductors is available in the Sixth Edition of The American Brass Company's Publication C-25. This 62-page booklet has a wealth of general information on the properties of copper conductors—plus convenient data for the most commonly used sizes of all types of rigid bus conductors.

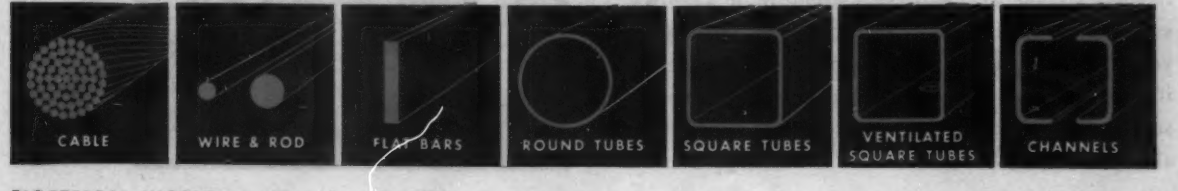
TECHNICAL SERVICES. Anaconda specialists are available to help you in the solution of technical problems involving the use of Anaconda Bus Conductors. For such service, or for a copy of Publication C-25, see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 8760

ANACONDA®

COPPER CONDUCTORS

Made by The American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



SAME voltage rating

. . . ANY strength

When substation design calls for buses to withstand high fault currents, there's often considerable economy in use of insulators of high cantilever strengths. Availability of such insulators affords freedom in structure design, and reduces total number of insulators and points-of-support required.

In the illustration above, the insulators shown are, in order, a Lapp Standard Station Post, a Lapp High Strength Station Post, a Lapp Extra High-Strength Station Post, and a "special" Lapp Station Post of still higher strength. It's "special" only because it doesn't happen to be in the most recent catalog, and because it doesn't fit any previously-established formal strength standards. A customer needed 10,000 lb. cantilever strength in a 23-Kv switch and bus insulator. He got it—in a hurry. If you need an insulator of such characteristics, specify it as Lapp No. 41398. If you need switch-and-bus supports in any other strength rating, we can probably make them, too. The merit of the Lapp Station Post design is reflected in the ease of its stress analysis. The simplicity of the post structure, the uniform reliability of Lapp porcelain, and the certainty of externally-attached caps—instead of pins or inserts—all are such that it is routinely possible to design an insulator into an unexplored strength field, without risk of unknown variables.

At any voltage rating, in any strength class, Lapp Station Posts give you an *extra* margin of operating security, low upkeep, long life.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use . . .

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4 6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

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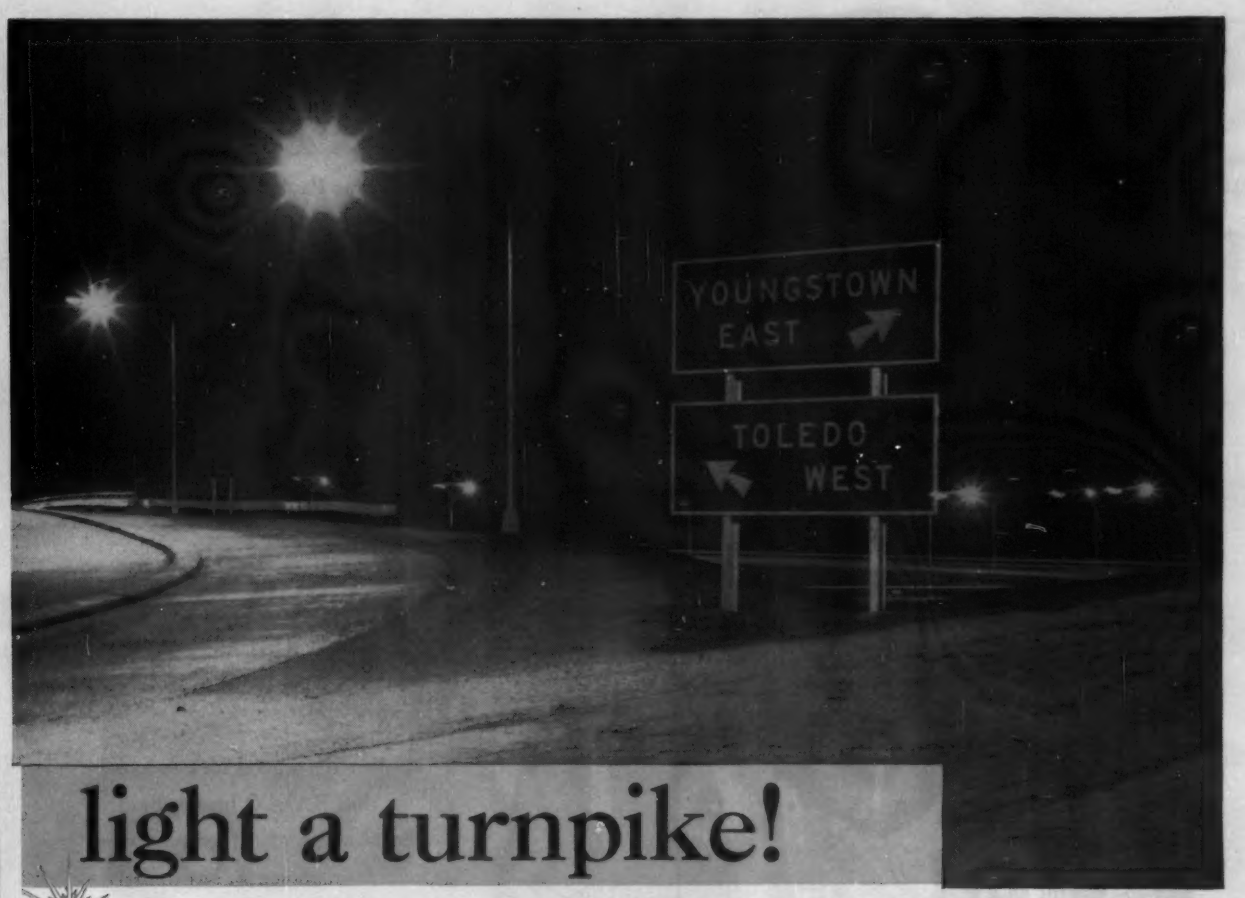
HERE'S the way to



light a turnpike!

The new Ohio Turnpike, spanning the state from Pennsylvania to Indiana, is a model of modern highway construction. And one of the outstanding features of this road is the lighting of the interchanges.

What an immense job it was to build this 241-mile road! Enough dirt was excavated to fill a two-lane tunnel 268 miles long. They dumped enough fill to cover 500 football fields to a depth of 28 feet. Carefully the bogs were drained, slides were stopped and the rock was blasted to make the great road possible.

Skillful engineering is apparent along every foot of the Turnpike—and this includes the selection of vital materials used to build it. Buried in the ground near the interchanges you'll find over half a million feet of Tiger Brand 3,000-volt internal shielded cable serving as main feeders. Many thousands of feet of Tiger Brand RR cable serve as bracket cable in the poles, and an additional quarter million feet of Tiger Brand cable grounds the entire system.

When you install Tiger Brand cable, you have gone a long way toward insuring a trouble-free wiring system.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL

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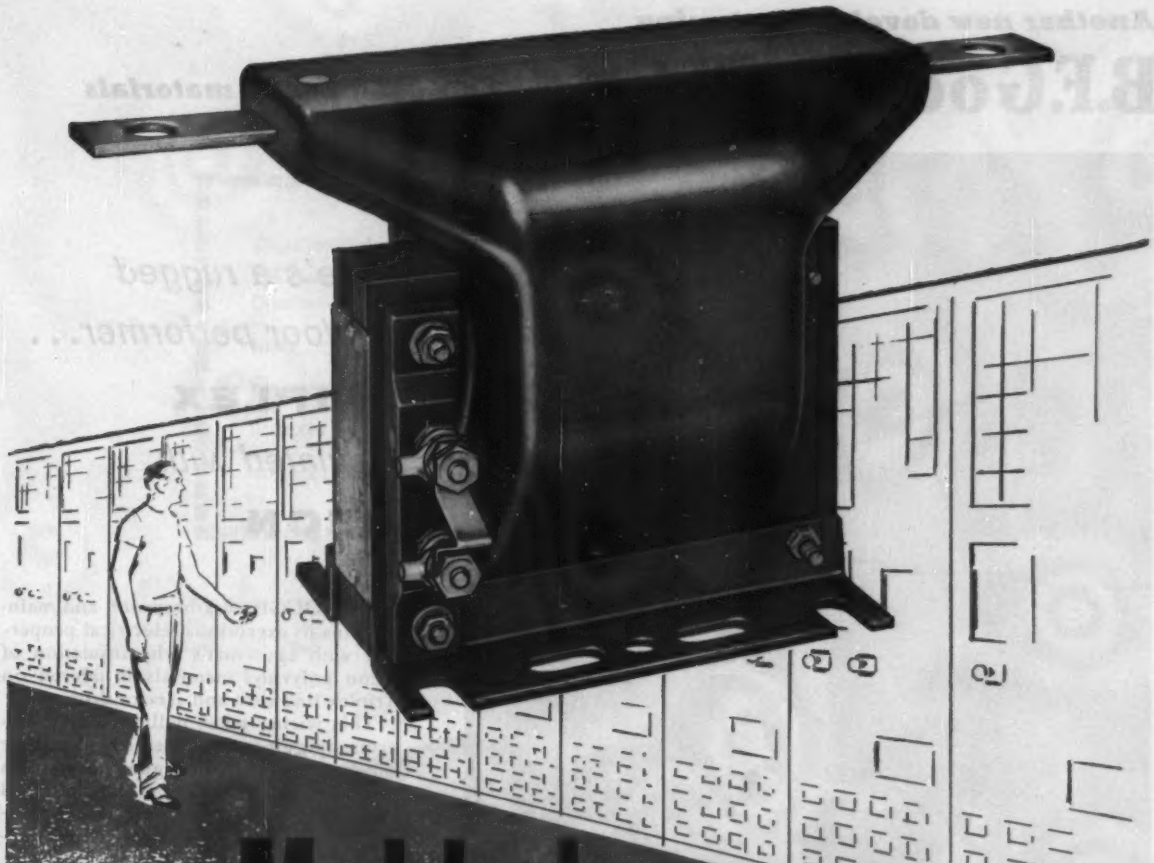
"A hundred twenty five foot long!" Babe, the Blue Ox, dropped the tape off his left horn as Paul Bunyan whistled in amazement. His breath leveled nine young saplings. "Babe, that there's shore some Douglas Fir pole. An' she's jest as smooth an' round an' straight as the legs of a Barbary Coast dancin' gal...Babe, I *know* this'n is a BAXCO Douglas Fir Pole* —without lookin' at the brand."

BAXCO
(*pressure treated*)
DOUGLAS
FIR POLES

* But it's a good idea to look for that BAXCO brand, Paul.. because it means the poles were cut from choice stands (mostly our own) of Coast type Douglas Fir timber—where trees grow extra tall and straight...it means the poles were carefully seasoned, inspected, machine shaved and machine incised full length before careful pressure treatment...and when you specify "BAXCO Douglas Fir Poles" of any size, you are assured of prompt service and rigid adherence to specifications. Inquire today.

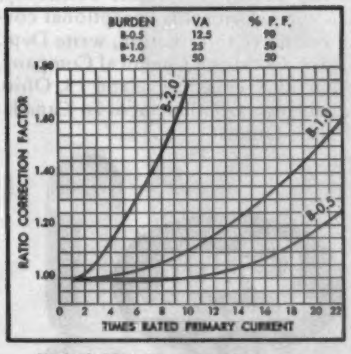
PRESSURE TREATMENTS AVAILABLE: *Creosote, Chemonite, Pentachlorophenol, in accordance with Federal and AWPA specifications.*

J. H. BAXTER & CO. *120 Montgomery Street, San Francisco 4, California*



NEW 5-Kv Molded CURRENT TRANSFORMER

...for Indicating and Tripping Service



Typical 60-cycle overcurrent curves for Type LRM current transformer.

Extends Line of Maintenance-free Epoxy-resin Units

Latest in a growing family of molded units, this Type LRM current transformer rated 5 kv is already a prime favorite with panel and switchgear designers. Molded of epoxy resin, this new transformer is virtually maintenance-free. It has high impact strength . . . resists mechanical forces, moisture and fire. These advantages at no extra cost.

All units are supplied with a short-circuiting strap, removable after installation. Base design permits mounting anywhere—on walls, bars, channels, etc.

Allis-Chalmers instrument transformers are available in the widest possible rating range. Many are molded units. Other epoxy-resin designs are in pilot production. For complete information, see your A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5503

Another new development using

B.F.Goodrich Chemical *raw materials*

Installation of Triplex wire manufactured by Southwire Company, Carrollton, Georgia.

Here's a rugged outdoor performer...

TRIPLEX

insulated with

GEON

IT'S TOUGH, weatherproof, and maintains its exceptional electrical properties with age—that's why insulation of Geon polyvinyl materials is offered on Triplex line wire and service drops.

This wiring takes pulling over crossarms, dragging along the ground and the other punishment that goes along with outdoor wire installation. The physical properties and aging characteristics exceed all accepted standards for this application.

The insulation of Geon polyvinyl materials shuns the sun, oxygen and ozone attack. In industrial areas, it withstands oils, greases and the effects of air-borne acids, alkalis and other chemicals. What's more, it resists flame, will not support combustion and has good flexing properties. The wire is light, small in diameter, free stripping, easy to handle and competitively priced.

For the greatest lifetime economy, choose wiring with this exceptional covering. For more information, write Dept. GE-5, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
a division of The B. F. Goodrich Company

B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

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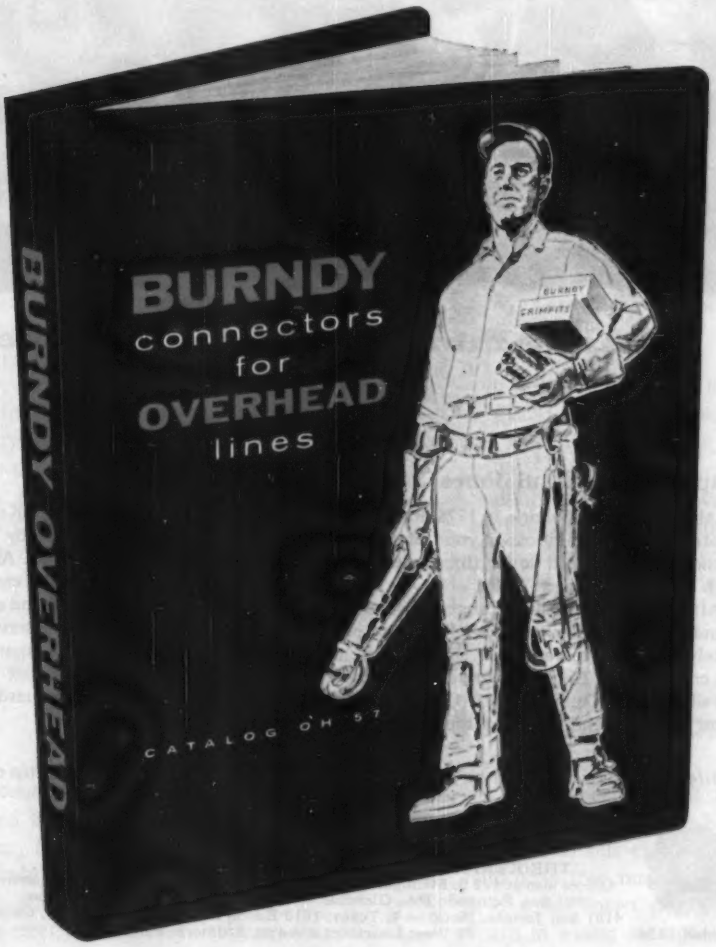

"I Am Ambitious Of Your Esteem"

Captain John Paul Jones:

To the Countess of Selkirk, in 1778, Paul Jones wrote ". . . I am ambitious of your esteem and friendship, and would do anything, consistent with my duty, to merit it."

After his men of the "Ranger" had commandeered the Selkirk's silver, Jones had privately promised to return it. Buying it from his crew for 140 English pounds, he returned the silver to the Countess in 1784. The Captain kept his word and won her lifelong esteem.

For more than a century, Kerite has been ambitious of your esteem—by building the most lasting cable yet known. And more than three generations of Kerite craftsmen have given of their inherited skill and craftsmanship to assure the long life and service of Kerite Cable. The Kerite Cable Company takes pride in the fact that their product is chosen by buyers of integrity to safeguard installations around the world.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

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Founded 1854

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
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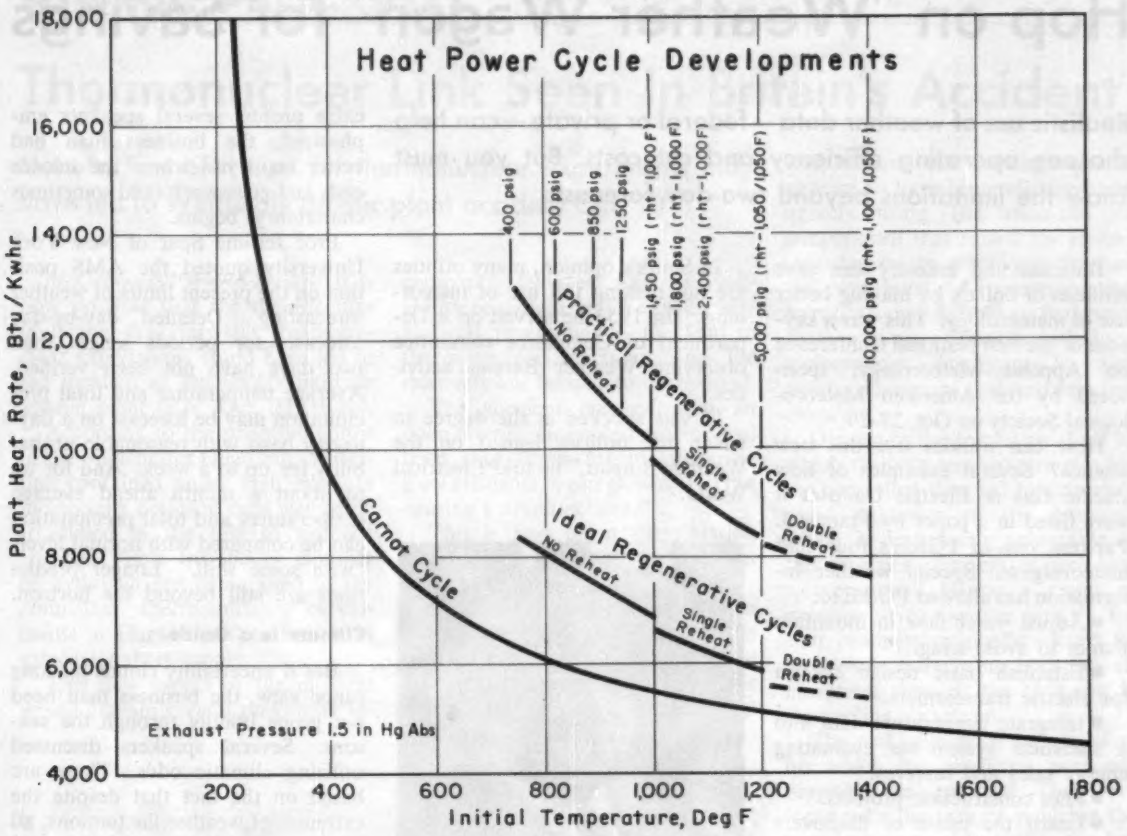


What Is Ahead for Generating Costs?

Higher steam pressures and temperatures do not provide the gains in power station economy available in the past. The above chart, prepared by Westinghouse, shows clearly the extent of past gains compared with those available from the practical regenerative cycles.

These facts along with indications that still larger units will not provide savings in cost per kilowatt of capacity are of great significance to the utility industry. For many years the increase in cost of fuel and the price of equipment has been substantially offset by improvements in power plant economy and larger unit sizes.

These days are over. In the future the savings will be much harder to find.

These facts are amplified by a General Electric Co statement appearing on page 130 of this issue.

The manufacturers and power plant designers will undoubtedly find new ways to save and to improve efficiency. But the utilities will have to give the same attention to this problem as they are to finding economic ways to generate with nuclear fuels.

Lost Forever To The Competition

Ninety percent of the new homes built in 1957 in the area served by Brooklyn Union Gas Co will be heated by gas. That is an outstanding record even for the gas industry which promotes heating in a most effective way.

But for the electrical industry, it means that 90% of the homes are lost forever not just for house heating, but for water heating and perhaps cooling as well. Is our electrical industry going to sit back and lose this business year in and year out? Or will some smart rate engineer find out that peak loads in winter are not the ghosts they once were.

Hop on "Weather Wagon" for Savings

Realistic use of weather data — federal or private — can help sharpen operating efficiency and cut costs. But you must know the limitations beyond two-day forecasts

Business and industry can save millions of dollars by making better use of meteorology. This was a keynote of the first National Conference on Applied Meteorology, sponsored by the American Meteorological Society on Oct. 28-29.

How can utilities use this new science? Several examples of how Pacific Gas & Electric Co uses it were listed in a paper by Francis J. Parsons, one of PG&E's four staff meteorolgists. Special weather information has allowed PG&E to:

- Adjust water flow in mountain flumes to avoid icing.
- Establish basic design criteria for electric transformers.
- Integrate temperature data into a statistical system for evaluating energy sales and reserves.
- Plan construction projects.
- Learn the cause of flashovers on a transmission line.
- Lick transmission line ice loading problems.

PG&E spends about $50,000 a year keeping tabs on the weather. Charles P. Smith, supervising gas supply & meteorological engineer, says this investment pays for itself many times over. The four-man meteorology department performs four broad functions:

1. Routine forecasting to permit scheduling of gas production, water and manpower use, construction.

2. Consulting on plant design, climatology, air pollution.

3. Monitoring potentially dangerous weather situations.

4. Directing experimental cloud seeding in watersheds.

Examples of applied meteorology listed by other speakers include: boosting power production efficiency by using day-to-day forecasts and long range degree-day estimates, anticipating power demand surges through cloud forecasts, solving air pollution problems by wind tunnel tests, and guarding wide areas against reactor stack emissions or accidental releases.

In Smith's opinion, many utilities are not making full use of meteorology. In 1953 he served on a Department of Commerce committee observing Weather Bureau activities.

"I was shocked at the degree to which the utilities leaned on the Weather Bureau," he told Electrical World.

SMITH: "I was shocked . . ."

"General weather bureau forecasts are largely useless for utilities because they aren't tailored to specific needs—the pinpointed situations of utilities." Weather analyses must be translated into basic profit-and-loss decisions—and that's the job of business, not government, Smith feels.

Should Have Own Weathermen

There isn't a utility that can't afford the price of private meteorology, Smith told Electrical World. Larger utilities probably will find it best to have their own meteorologists as part of the operating team, in on all the problems. Otherwise, good relationships—and reliable forecasts—can be established with consultants.

But before using the budding science of meteorology to stack up extra profits, several speakers emphasized, the business man had better know just where the science ends and guesswork (and sometimes charlatanry) begins.

Prof Jerome Spar of New York University quoted the AMS position on the present limits of weather forecasting. Detailed day-by-day forecasts for periods longer than two days have not been verified. Average temperature and total precipitation may be forecast on a day-to-day basis with reasonable probability for up to a week. And for up to about a month ahead average temperatures and total precipitation can be compared with normal levels "with some skill." Longer predictions are still beyond the horizon.

Climate Is a Guide

But if uncertainty clouds his long range view, the business man need not grope blindly through the seasons. Several speakers discussed utilizing climatic odds. These are based on the fact that despite the extremes of weather fluctuations, all remain within an essentially static climatic range. Using temperature records, a person can determine normal temperature, and how unlikely variation would be.

Set Up Cost/Loss Ratio

But even when basing operational decisions on 24 hour forecasts, J. C. Thompson, U. S. Weather Bureau emphasized, a range of probability must be taken into account. The "Operational Research" approach starts with an analyses of the operation, of all the factors hinging on the decision. Before accepting any odds, a planner should set up a cost/loss ratio. Before acting on a storm warning, for example, a business man should ask himself: How much would protective measures cost compared to storm damage? And, how does the ratio of cost/loss compare with the probability that the weatherman's prediction will be accurate?

One drawback to basing operational decisions on weather predictions, Thompson admitted, is the fact that one weatherman might be more accurate than another.

Thermonuclear Link Seen In Britain's Accident

Manufacture of tritium for thermonuclear experiments may have led to Windscale atomic plant accident Oct. 10

McGraw-Hill World News—It is now possible that the manufacture of tritium for Harwell's thermonuclear experiments could have led to the incident at Britain's Windscale atomic plant (EW, Oct. 21, p 40).

According to the scientific editor of the Manchester Guardian, deuterium contained under high pressure in specially designed cans was being irradiated in the pile to produce tritium. These two heavy isotopes of hydrogen are being used in the controlled thermonuclear experiments at Harwell and tritium is in extremely short supply.

This new aspect of the incident would explain several previously incompatible features. And the availability of tritium might explain why Harwell reputedly has the lead in thermonuclear reaction using the relatively low temperatures reported.

The accident occured after an open-circuit, air-cooled reactor had been shut down for maintenance. Fuel elements began glowing red hot causing a uranium "fire."

This is how mean the situation now looks to have been on the night of Oct. 10:

Physicists were forced to contain the high pressure gas in cans made of light material which would not absorb many neutrons and so upset the reaction in the pile. At normal temperatures this canning material appears to have been adjudged adequately strong. But when the pile temperature was raised for routine annealing on the graphite in the core, the cans burst. As deuterium behaves chemically like hydrogen, there was an explosion with local temperatures significant to melt nearby aluminum clad uranium fuel elements.

Oxygen in the forced air draft by which the core temperature was being controlled then led to extremely rapid oxidation of the uranium, which is particularly vulnerable to this chemical process at red heat temperatures. Hence a cloud of uranium oxide together with the fission products originally locked up in the can were being borne to atmosphere through the chimney in the cooling air stream.

The real ugliness of the situation, for which the physicists were not prepared, then emerged. They were faced with the task of reducing the temperature quickly before the hot region enveloped more fuel elements. But they could not go on blowing cooling air through the pile. This would distribute the combustion products out of the chimney: if they stopped, the combustion region would extend and there would still be a sufficient natural circulation through the chimney by which the process could continue and the poison still escape. They couldn't use water until lengthy calculations had been made showing that it would not accellerate the combustion process rather than snuff it.

Thermal Shield Rises at England Site

Towering cranes speed construction of the thermal shield at Berkely Power Station in Gloucestershire, England. A biological shield will be erected around the thermal structure. The bottom dome will be brought in on the railroad tracks. Berkely is a Calder Hall type plant. It will have 275-Mw capacity.

NUCLEAR NOTES

A 200-Mw nuclear power plant may be built in northern California by 1965, Norman Sutherland, Pacific Gas & Electric Co president, has announced.

A 100-hr course in nuclear reactor engineering has been started for 35 Georgia Power Co engineers.

Develop Young Men, Declares Ed Stultz, New Potomac Prexy

- It's up to utilities to find and help employees whose potential sometimes may be latent
- On federal encroachment, the 56-yr-old Potomac Edison head believes a practical answer lies between extremes of political 'war' and concentration on service and low rates
- A soft-spoken man, Stultz rose through district and commercial posts despite a trolley car incident

A high level of industrial activity means that many well-qualified young men are being won by other industries. It's up to utilities to find men of sometimes latent promise, and perhaps somewhat short on formal higher education, and encourage and help them to meet opportunity in management ranks.

This cogent observation comes from one of the industry's newer company presidents: 56-year old Daniel Edgar Stultz, new boss of Potomac Edison Co., an unassuming, soft-spoken man. With deep conviction, Ed Stultz believes utilities must find and develop men of ability to become part of management in the future.

Toward this end, Stultz says Potomac Edison has set up manpower development programs for employees which he intends to back solidly. In addition, the company has management development programs for junior executives.

Stultz considers the activities of the federal government in the power field to be one of the industry's more urgent problems.

"Years ago," he recalls, "an exchange between two utility executives made a profound impression on me. One executive, in addressing a meeting, said, in effect, that utilities should wage political war against politicians who back federal power projects. The other executive, affectionally called Senator by his colleagues, then arose to speak:

"'If I had been challenged to a duel,' said the Senator, 'I wouldn't pick pistols if my opponent was a marksman. And I believe you will be doing this if you try to fight federal power through political means. I think you ought to concentrate on giving the best possible service at the cheapest rates, and this will bring you victory in the end.'"

Moderate Point of View

Stultz believes a practical answer lies somewhere between the two extremes. Potomac Edison will continue its efforts to merit the public's endorsement of private enterprise through quality service and reasonable rates, he says.

Born and reared in Frederick County, Maryland, Ed Stultz joined Potomac Edison after finishing public school. The company was young at the time and its staff was small. Stultz amassed a variety of experience. He helped build company facilities and install motors for industrial customers.

At that time, the company owned the street car system in Frederick. He and an associate were sent out one day to install electric service for a new customer. They put in the service and returned proudly to the office.

"We had hardly arrived when the phone rang," Stultz reminisces. "It was our new customer. He said his lights worked fine until a street car went by. 'Now there's a terrible fire,' the customer said.

"We'd installed the service drop under the trolley wire."

Despite this blow to his pride, Ed Stultz soon began to forge ahead. In 3½ years, he became district manager at Berkeley Springs, W. Va. When he wasn't busy "keeping the steam and hydro plants going," he enjoyed fishing the Cacapon River for bass, or hunting wild turkeys.

In 2½ years he became district manager of Winchester, Va., district. In nine more years he became commercial manager of the Potomac Edison system.

Then in 1953 he became executive vice-president—his last promotion until June of this year when he succeeded R. Paul Smith as president. The company has approximately 340,000 customers.

Ed Stultz is married and has three sons. He golfs at every opportunity and shoots in the high 80's "on courses around home."

Arrester Failure Blacks Out Twin Cities

Two-hour outage affects about 1 million people in St. Paul and Minneapolis region. Explosion of 115-kv lightning arrester during switching caused generation bus flashover. A cascading interruption on system followed, despite emergency steps

A blackout lasting up to two hours hit the Minneapolis-St. Paul area Oct. 31. The interruption affected about one million people in service areas of Northern States Power Co.

An explosion of a 115-kv lightning arrester on the reserve station service bank at the company's Black Dog plant was the origin of the trouble, according to a company spokesman. The blast occurred during switching preparatory to maintenance. After the switching, the bank would have backed up capacity for station auxiliaries.

The explosion caused a bus section flashover which knocked off all generation at the 300-Mw Black Dog plant. The plant went down at 8:44 AM, dropping its 268-Mw output. Total system load at the time was 1,120 Mw.

The resulting deficinecy caused a cascading interruption on NSP's system despite an instant application of the company's emergency load rejection plan. According to the spokesman, the plan is designed to secure 100 Mw relief in 1 min.

Continuing cascading threw the system into instability until only one 100-Mw generator was operating in the Twin Cities. Operators cut the system apart to reduce load and permit picking up generation manually.

The blackout lasted about two hours. Parts of Minneapolis were restored in slightly more than an hour, however. The St. Paul network served by the one machine still in service was unaffected.

Customers felt the impact from Eau Claire, Wis., 100 miles east of the Twin Cities, to a 25 to 50 mile radius in other directions.

Northern States went on the radio as quickly as possible, the spokesman said. The outage had stilled all but one radio station, however, and with most homeowners off the line the messages had little effect.

Customers have reacted favorably to newspaper accounts of the outage, NSP's spokesman said. A few industrial users were critical because of the lost manhours involved.

Civil Defense officers in the region have expressed concern about the crippling impact that follows a loss of radio and television power.

Hospitals and the telephone company switched to emergency power to continue operations during the blackout. Traffic jams developed during the morning rush hour as traffic signals went dark. Police sent special details to guard all the banks with silenced alarm systems.

A swamped switchboard found the fire department turning aside complaints of smoking stokers, hot wires, and balky refrigerators. Firemen responded only to "legitimate" alarms. No reports of serious fires or damage followed the interruption.

Brief Holiday for Some

At least two quarters registered no complaint. Students at the University of Minnesota were excused from windowless classrooms. And typists at government offices relaxed until their electric typewriters were reenergized.

A company spokesman said that the power failure threw the system load onto 57 other NSP plants in the company's interconnected system. The surge brought a cut off at all stations except where the one 100-Mw unit was still in service.

FPC Reports 761.2 Mw Net Capacity Gain

PLANT ADDITIONS DURING AUGUST

State	Utility	Plant	Fuel	Capacity
Colo.	Public Service Co. of Colorado	Cherokee	S	100,000
Fla.	Tampa Electric Co	F. J. Gannon	S	125,000
Idaho	Bureau of Reclamation	Palisades	H	28,500
Ill.	Rantoul Municipal Light & Power Plant	Rantoul	IC	1,500
Ill.	Geneseo Municipal Utilities	Geneseo	IC	2,000
Kan.	Baldwin City Municipal Light & Water Dept.	Baldwin	IC	1,135
Mass.	Nantucket Gas & Electric Co	Nantucket	IC	1,500
Mo.	Memphis Municipal Light & Water Plant	Memphis	IC	900
Nev.	Southern Nevada Power Co	Clark	S	60,000
N. H.	Public Service Co of N. H	Schiller	S	44,000
N. J.	Public Service Electric Gas Co	Linden	S	225,000
Ohio	Ohio Power Co	Philo	S	125,000
Okla.	Okeene Municipal Light & Water Dept	Okeene	IC	350
Tenn.	Tapoco, Inc	Chilhowee	H	16,667
Wash.	U. S. Army Engineers	Chief Joseph	H	64,000

RETIREMENTS

Ill.	Commonwealth Edison Co	De Kalb	S	7,500
Ill.	Flora Municipal Light & Water Plant	Flora	S	6,000
Ill.	Geneseo Municipal Utilities	Geneseo	IC	282
Kans.	Baldwin City Municipal Light & Water Dept.	Baldwin	IC	168
Mass.	Nantucket Gas & Electric Co	Nantucket	S	500
N. Y.	Gordon H. Bigelow	No. 2	H	700
N. Y.	Rochester Gas & Electric Corp	Rochester 4	H	800
Ohio	Dayton Power & Light Co	Sabina	IC	1,156
Pa.	Pennsylvania Power & Light Co	Surburban	S	48,000
Tenn.	Dyersburg Water & Light Dept	Dyersburg	S	15,500
Tex.	Southwestern Public Service Co	Lubbock	IC	1,532
Tex.	Southwestern Public Service Co	Plainview	IC	752

U. S.	Hydro	Steam	IC	Total
Added	109,167	679,000	7,385	795,552
Retired	1,500	77,500	3,890	82,890
Adjustments Plus	14,720	28,445	6,461	49,636
Adjustments Minus	780	.....	271	1,051
Net Change	121,607	629,955	9,685	761,247

H—Hydro, S—Steam, IC—Internal Combustion

U. S. Capacity as of September 1—Hydro, 26,546,116 kw; Steam, 96,718,765 kw; IC, 2,489,078 kw; Total, 125,753,959 kw.

Of Loans and Leases

Joining a trend which has developed gradually over the past decade, two rural electric co-op groups are making plans to build generating-transmission facilities which they will lease to private utilities.

The first, Kansas Electric Co-operatives, is seeking a $5,775,000 loan from REA to build a steam plant. The four-member group would lease the plant to Central Kansas Power Co, from which they now buy power.

The second, South Mississippi Power Assn, is asking for a $19-million REA loan to construct a 22,500-kw steam unit. The seven member co-ops have proposed that the project, with transmission facilities, would be lease-operated by Mississippi Power Co.

Other co-ops working under similar arrangements with private utilities include Dakotas Electric Co-op, which has an agreement with Montana-Dakota Utilities; Central Iowa Power Co-op, with Iowa EL&P; Rushmore (S. D.) G&T Electric Co-op, with Black Hills P&L; Arkansas Valley G&T, with Colorado Power; and Colorado-Ute Electric Assn, with Western Colorado Power.

TV Takes Its Toll

Because of a fire in their TV set, Mr. and Mrs. Frank J. Mello are suing Sacramento Municipal Utility District for over $55,000.

The couple contends the fire was caused by a short circuit in a SMUD transformer near their home and that SMUD was negligent in maintaining the transformer.

The $55,000 would compensate Mrs. Mello for injuries to her back and nervous system in putting out the TV fire before it burned down the house. They also seek $441.86 for repairs to the TV set.

Fibrillation Fight Advances

In the not too distant future line truck apparatus may be available to defibrillate the heart muscles of electrocution victims. The device, when perfected, is expected to combine a heart driving mechanism.

This is the outlook of William C. Bremner, Commonwealth Edison Co's superintendent of safety. A member of Edison Electric Institute's Accident Prevention Committee, Bremner recently reported on the progress gained during research on ventricular defibrillators.

Fibrillation or quivering of the heart often results from low voltage shocks. It halts blood circulation and causes permanent brain damage unless halted within 4 min. Experiments on more than 400 dogs and 11 humans have brought these conclusions:

- Ventricular fibrillation can occur when 1/10 amp of 60 cycle current flows from the hands to feet for about 1 sec.
- It can be stopped by a flow of 5 amp for ¼ sec.
- For adults the flow is 480-v, 60-cycle, ac.
- Current is applied through two 3½-in. diam electrodes greased with cardiac jelly.
- Defibrillating current can be applied to a person whose heart is beating normally without injury.
- The device is 99% successful after ½-min fibrillation; 90% after 1 min; 38% after 1½ min; and 27% after 2 min.

Research aims of the future are to perfect a field device, enlarge the time interval between shock and successful defibrillation, and develop an electrical heart "driving" mechanism to restore normal heart beat following defibrillation.

A Leap Into the Black

With soaring sales and a large backlog of unfilled orders, business at Westinghouse Electric Corp has recovered from the devastating effects of the long strike in late 1955 and much of 1956.

The company, with peak sales of $1,477,273,000 for the first nine months of 1957, jumped out of the red to set a new sales high, 22% over 1954's previous high. During these nine months, net income was $49,102,000 ($2.83 per common share), compared to a net loss of $1,399,000 during that period last year. Net income at end of the third quarter was $18,487,000 ($1.07 per common); figures same period last year were $16,417,000, with $.95 per common.

As to the future, Pres Gwilym A. Price indicates the high volume of backlogged shipments, especially apparatus, will continue. Consumer product sales to distributors and dealers this September were "considerably ahead" of last year, he said.

Pact Solves Power Problem

The federal government and Georgia Power Co have settled their seven-year dispute over methods of distributing power from U. S. dams in Georgia and northern Florida.

The new contract provides that Georgia Power facilities will be used to transmit power from four existing federal dams—Buford, Allatoona, Clark Hill, and Jim Woodruff—to preference customers. In return, the utility will receive a wheeling fee of $65,000 a month. Under the agreement, the government will sell power at 6 mills/kwhr to preference customers and at 2.96 mills/kwhr to Georgia Power. Similar arrangements will be made upon completion of federal dams now being built, such as Hartwell and Fort Gaines.

RMEL SPEAKERS at Colorado Springs included, left to right: W. T. Lucking, Arizona PS; R. T. Person, PS Co of Colorado; J. W. McAfee, Union Electric; K. M. Robinson, Washington Water Power, and H. H. Scaff, Ebasco Services, Inc.

Rocky Mountain Electrical League hears . . .

Inflation Pressures Rates Upward

Colorado Springs meeting told such boosts, assuring earnings, would spur investors to supply $35 billion required

The long-standing effort of utility companies to maintain and even reduce electric rates may soon end, the Rocky Mountain Electrical League was told at its Oct. 13-17 annual meeting at Colorado Springs, Colo.

This effort was sustained by the continuing reduction in plant first cost and a 3% annual improvement in thermal station heat rate, said G. B. Warren, General Electric Co. But such support, he said, cannot continue in the face of inflationary pressures.

Heat Rate Slows Down

The heat rate improvement rate has slowed down until only a 1% annual gain can now be expected, Warren declared, pointing out that despite reluctance, manufacturers will raise equipment prices.

Need for more than $35 billion from outside sources for expansion capital poses utilities with a critical problem, declared H. H. Scaff, Ebasco Services. Unless higher rates boost investors' earnings, he said, investors may prefer more favorable stocks. Additional pennies per day per customer, he said, would provide the financial stability necessary for utilities' proper discharge of public responsibilities.

Rate rises can be deferred only on the basis of favorable finding in a re-examination of off-peak power business, said D. B. Hyer Jr, Southern Colorado Power Co president. He advocated special schedules to attract such business. The resulting boost in net income, he said, would compensate for the rate structure complication, and regulatory bodies would cooperate once convinced that this action would aid in postponing general rate increases.

J. W. McAfee, Union Electric Co president, warned that utilities investing heavily in nuclear power could attract investors only by finding a means of defraying its costs.

Future Owes Past

As tomorrow's customers will gain by such development, he said, it is only reasonable that they should pay some of today's costs. In the long period of steam-cycle improvement, he noted, customers paid higher bills to cover research and development which ultimately brought the efficiencies underlying present low rates.

McAfee proposed that government do the fundamental nuclear research as such research is applicable to the weapons program. Industry groups, he said, should use this basic knowledge in building prototype reactors.

Walter T. Lucking, Arizona Public Service Co president, said that well informed employees could promote public understanding of utility company policies and problems. Utah Power & Light Co's president, E. M. Naughton, urged utilities to engage in a grass-roots customers' public relations effort to halt the spread of federal power.

The administration's partnership program has given impetus to the expansion of utilities in the Pacific Northwest Power Pool, said Kinsey M. Robinson, president and board chairman, Washington Water Power Co. The pool requires 500 new Mw yearly for present load growth, he said, and now has 4,338 Mw under construction or licensed.

The capacity being installed by Washington State PUD's would have been impossible without credit backing of investor-owned pool utilities, he said, terming this a good example of "partnership."

Tennessee Valley Authority power rates would require a 94% boost if TVA paid taxes and borrowing charges and worked to a reasonable rate of return, said Edwin Vennard, Edison Electric Institute managing director. This adjustment should be made to prevent taxpayers outside TVA's service area from subsidizing the operation, he said.

R. G. RINCLIFFE, Vice President; A. D. BARNEY, former President; W. C. BECKJORD, new President

Beckjord Succeeds Barney at AEIC Helm as Membership and Research Hit Highs

10 Highlights of AEIC Meeting

1 The Connecticut coordinated capacity plan is now in action with the initial unit in service.

2 Sample testing of watthour meters could increase accuracy and cut costs.

3 Generation progress this year did not equal earlier years in larger equipment, higher pressures and temperatures, and unusual design.

4 Practice of submetering and resale is declining in most areas, according to a survey.

5 Growing attention is being given to stack discharges of sulphur and nitrous oxides.

6 A survey of 1,400 capacitor-switching installations is expected to provide manufacturers with results to guide them in future design.

7 There is a strong possibility that the changing pattern of peak loads will materially increase utility investment per dollar of gross revenue.

8 The increasing importance of summer loads is emphasized by recent load research studies.

9 Utilities have the responsibility of assuring that reasonably priced service of appliances is available in their areas.

10 In today's complex market, sales research is a must to give utilities pertinent data on which to base sales plans and decisions.

Representatives of 62 operating utilities met at The Greenbrier, White Sulphur Springs, W. Va., Oct. 23-26 for the 73rd annual meeting of the Association of Edison Illuminating Companies.

The attendance was increased by six companies admitted to membership this year: Carolina Power & Light Co, Illinois Power Co, Iowa-Illinois Gas & Electric Co, Long Island Lighting Co, New York State Electric & Gas Corp, and Texas Power & Light Co. And, at the meeting, the AEIC approved changes in its by-laws to admit holding companies to membership.

W. C. Beckjord, president of Cincinnati Gas & Electric Co, was elected the new president of the AEIC. He succeeds A. D. Barney, chairman of Hartford Electric Light Co. New vice president of the association is R. G. Rincliffe, president of Philadelphia Electric Co. Robert Gale was re-elected secretary and treasurer, and all members of the Executive Committee were re-elected.

The secretary reported that the AEIC is currently supporting research projects in many fields: extra-high-voltage cable; soil thermal resistivity; revision of the ASME steam tables; the heat pump; wood poles; recovery voltages; corrosion and deposits from combustion gases; and coal preparation and utilization.

1 Connecticut Capacity Plan

Four Connecticut utilities are now "in business" with a joint long-range plan for reducing the cost of supplying bulk power, A. D. Barney, president of AEIC and chairman of Hartford Electric Light Co, told the group. His company participates with Connecticut Light &

Power Co, Connecticut Power Co, and United Illuminating Co in a "one-system" approach to planning generation and transmission. He announced that, after five years work on the plan, the initial participation unit is now in service at United Illuminating's Bridgeport Harbor Station.

The plan will afford "substantial" economies, Barney said. And it does not obliterate the indivdual corporate entities of the participants.

The participants buy from or sell to each other such capacity as required to maintain equal percentages of reserve capacity at peak load. Each assumes the same percentage of fixed and operating costs as its share of the output. Participation ceases when the owner of a shared unit requires total capacity of the unit on an equalized reserve basis. (Full details of this program will be published soon.)

2 Meter and Service Methods

Today's meter provides ten times more capacity per dollar than the 1925 meter, costs less to maintain, has better sustained accuracy, and registers loads 50% greater. This meter is suited for sample testing rather than the periodic testing required by most state commissions, stated J. S. Lineback, chairman of the Committee on Meter and Service Methods and superintendent, electric meter department, Cincinnati Gas & Electric Co.

"The metering system could be more accurately maintained at less expense if a sampling procedure were generally accepted by state commissions on a permanent basis." However, he said, "work is still to be done to arrive at a proper formula or method to apply which will be universally accepted by commissions."

Testing requirements of many state commissions are "based on the performance of older type meters which do not have the inherent sustained accuracy of the modern meter," said Lineback. He estimated that 8½ million meters are still in service whose accuracy is "inherently affected by temperature, and they will register low on overloads in proportion to the extent of the overload."

3 Power Generation

Although major strides were made in recent years toward larger generation equipment, higher pressures and temperatures, and unusual design, this year showed no startling innovations. I. L. Wade, chairman of the Committee on Power Generation and general superintendent of generating stations, Commonwealth Edison Co, pointed out that no units above 325,000 kw were ordered this past year, while two 450,000-kw units were ordered the previous year.

Furthermore, maximum steam temperatures have reached a practical ceiling of 1050F, because of metallurgical problems. Steam pressures between 2,000 and 2,400 psi for large units have been generally accepted. However, only one super-critical-pressure unit was ordered last year, compared with three the previous year.

In nuclear generation, Wade pointed out, the industry has a total of 642 Mw under construction and 612 Mw more planned. Last year only 60 Mw was being built, and another 791 Mw was planned.

Wade noted a trend toward the gas turbine. Units ordered this year for utility generation range from 5,000 to 21,500 kw. They were purchased primarily for peak power, hydro backup, and stand-by.

4 Wholesale and Resale Problems

A survey of 32 utilities revealed these trends in wholesale service to retail customers for resale to third parties, according to C. T. Bremicker, vice president, Northern States Power Co:

• The practice of submetering and resale is declining in most areas. "The trend is definitely toward its

(*Continued on next page*)

TECHNICAL COMMITTEEMEN: (l to r) J. S. LINEBACK, Meter Chairman; I. L. WADE, Generation Chairman; PAUL THOMPSON, Committee Advisor; A. L. PENNIMAN, JR, who presided over the reports of the AEIC technical committees

CHAIRMEN: G. V. WILLIAMSON, Air Pollution; R. G. MEYERAND, Switchgear; J. A. TENBROOK, Distribution

eventual elimination," Bremicker told the group.

- The practice of redistribution or rent inclusion is generally static, although many companies apparently would like to eliminate it.
- The practice of permitting combinations of buildings on a single master meter is declining, but not as strongly as submetering and resale.
- Most companies "appear reasonably well satisfied with their present policies and practices" of submetering and redistribution.
- There is little evidence of concerted action by such groups as realtors and building owners to influence utility policies of submetering and resale, or redistribution and rent inclusion.

5 Air Pollution Policy

"The most noteworthy current development" in air pollution control is the growing attention to stack discharges other than smoke and fly ash from burning both oil and coal. G. V. Williamson, chairman of the Committee on Air Pollution Policy and vice president of Union Electric Co, reported that research is being devoted to discharge of sulphur and nitrous oxides. The latter have been identified as specific irritants which can be generated by boiler equipment.

Control of sulphur oxide discharge has been effected generally by adequate stack heights and high exit velocities, along with attention to prevailing winds. Principal improvements in the quantity of this discharge have resulted from fuel selection and beneficiaton of coal by washing at the mine.

6 Electric Switching and Switchgear

A survey of capacitor-switching devices disclosed that 30% of the companies questioned experienced difficulty with switchgear. But, detailed information collected on 1,400 installations will prove useful to manufacturers as a guide in designing devices specifically for this type of switching, said R. G. Meyerand, chairman of the Committee on Electric Switching and Switchgear and chief electrical engineer of Union Electric Co.

Recovery voltage rise conditions on present and future systems are also being studied by the committee. Meyerand noted the timeliness of this work, as high-voltage air-blast breakers are particularly sensitive to high rates of recovery voltage. The study is expected to furnish values of system recovery voltage rates of rise that will be useful in forming circuit breaker design standards.

An improvement in defects chargeable to the manufacturers for 2.5-kv and higher-voltage metal-clad switchgear is indicated in preliminary information collected in the 1956 Switchgear Performance Report. But, Meyerand noted, there has been a slight upturn in defects for oil and oil-less circuit breakers.

7 Power Distribution

Focusing attention on the changing pattern of peak loads, J. A. TenBrook, chief system planning engineer of Philadelphia Electric Co and chairman of the Committee on Power Distribution, pointed out that this summer's peaks indicate that most northern companies now face equal summer and winter peaks.

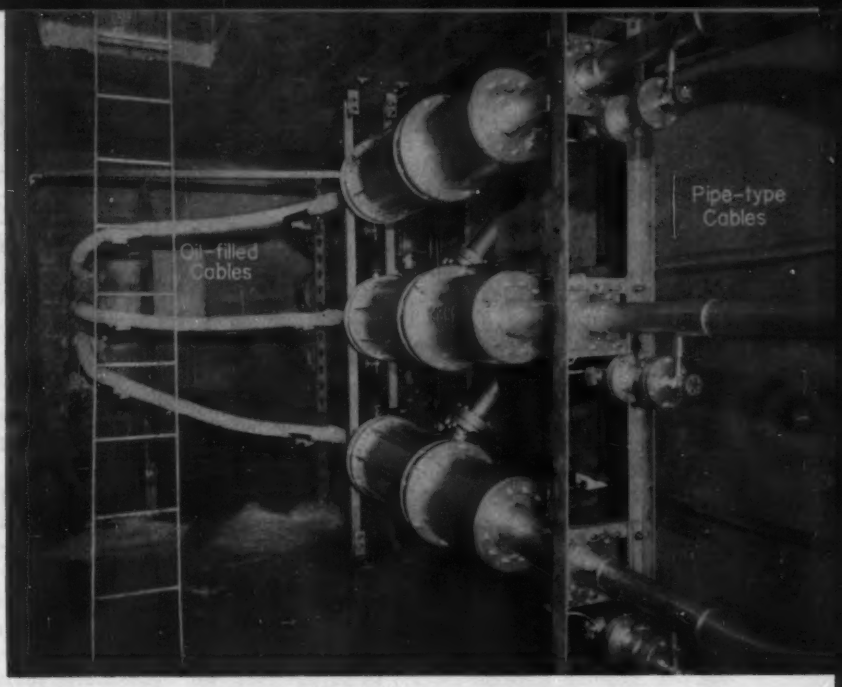
While winter peak loads vary only ±5% from most estimates, summer peaks show a much wider variation. This results from a higher percentage of temperature-sensitive load and an increased sensitivity per degree of temperature change, he said.

In the northern states, TenBrook noted, air conditioning is now about 25% of possible summer load and will be 35% in 1962. Its coincidence factor ranges from 20% at 77F to 95% at 103F. This 95% coincidence factor will be reached only one year in 25, but

(*Continued on page* 138)

Joins 69-Kv Pipe-Type to Oil-Filled Cable

Stop joint extends economic advantages of pipe-type cables used in conjunction with runs of oil-filled cable



STOP JOINTS of new type are about 8.5 ft long. They are mounted on 30-in. centers with the center line about 18 in. from the wall. Manhole built around existing oil-filled cable run is 25 ft long, 8 ft wide, and 9 ft high

R. H. BOLLING, Transmission & Distribution Section, Electrical Engineering Division, Philadelphia Electric Co, Philadelphia, Pa.

A new stop joint for connecting 69-kv pipe-type cable to oil-filled cable extends the economic advantages of pipe-type cable for Philadelphia Electric Co. Six joints are in service in new supply lines feeding the company's 66-13.2-kv Lombard substation. Joints were installed in just five days of around-the-clock work, satisfying the company's desire to minimize the outage time of the oil-filled cable.

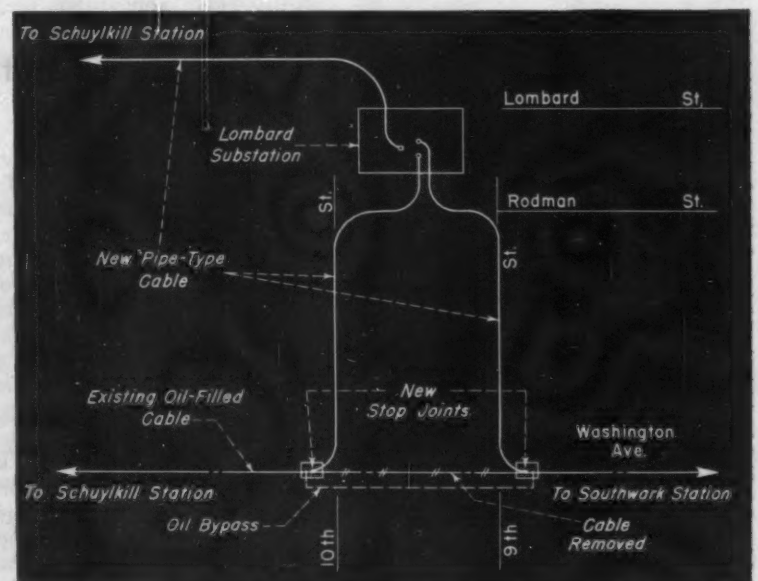
Development Justified

In supplying Lombard substation, the advantages of pipe-type cable in conjunction with established runs of oil-filled cable were enough to justify development of a practical method of connecting these dissimilar cables. Cooperation with high-voltage cable and accessory manufacturers produced the first satisfactory stop joints.

Lombard substation is supplied by two new 69-kv, 100-Mva cables. One is a 10,200-ft pipe-type cable from Schuylkill Generating Station; the other a 5,600-ft loop on an oil-filled cable between Schuylkill and Southwark Stations.

Pipe-type cable for the loop was attractive not only for economical reasons but also because congested street conditions would have made conduit and manhole construction difficult. And, the oil supply system is simplified by use of pipe-type cable, as the loop is supplied from Lombard substation. Oil reservoirs and alarms are unnecessary.

The oil-filled line has three 69-kv, 1,500-MCM copper, paper-insulated, lead-sheathed cables in concrete-jacketed fiber ducts. Pipe-type cable is composed of three 69-kv, 1,500-MCM copper conductors with



MAKING NEW LOOP of pipe-type cable was attractive because congested street conditions would have made installation of oil-filled cable system difficult

paper insulation in 6⅝-in. OD steel pipe with a somastic coating.

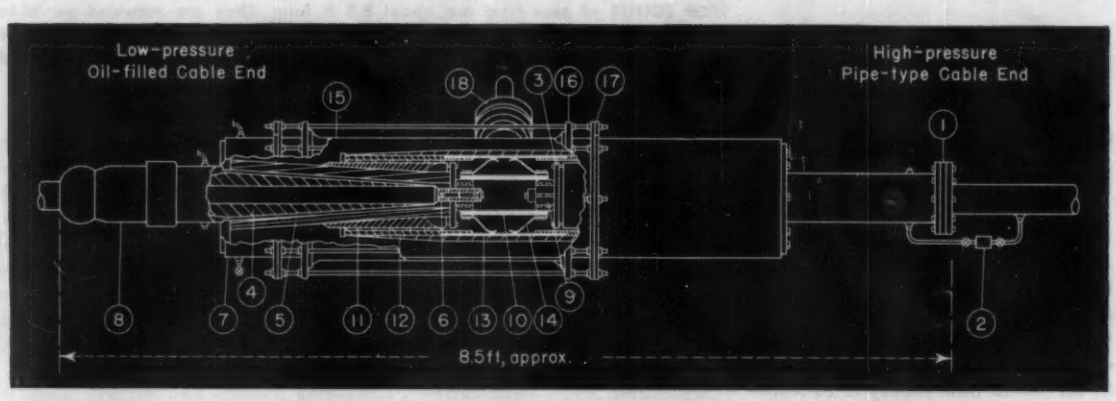
A partial cross-section of the 69-kv single-conductor stop joint is shown below. The 6⅝-in. pipe terminates in the manhole with a trifurcating chamber; cables are carried to the stop joints in separate copper pipes. Overall length of the completed joint is about 8.5 ft. The manhole is 25 ft long, 8 ft wide with about 9 ft head room. It was constructed around the oil-filled cable duct run. Joints are vertically mounted on 30-in. centers, and their center line measures 18 in. from the wall.

Before installation, a completely assembled joint withstood all mechanical tests in the supplier's high-voltage laboratory. Electrical tests were made in accordance with AIEE No. 48—Standard for Potheads and AEIC Specifications for Pipe-Type Cable. The joint successfully withstood tests at the 69-kv level. Successively higher voltages were applied for 6-hr periods until the cable failed outside the joint after 26 min at 172 kv. Dissection revealed no deterioration of components.

Oil Systems Separate

All joints have oil systems separate from the high and low-pressure systems of the pipe-type and oil-filled cables. The joint casing contains about 30 gal of Cablene A oil maintained at 5 to 12 psi by a separate 4-gal reservoir. Any two or all three joint casing oil systems may be connected by a paralleling manifold to allow removal of one or two reservoirs for servicing. An alarm manifold for each joint provides a pressure switch, gauge, and relief valve. Abnormally high or low pressure on any joint casing oil system actuates through its pressure switch an alarm at an attended substation nearby.

The two new manholes containing the stop joints are one block apart. When the line was looped through Lombard substation, the de-energized oil-filled cables between the new joint manholes were removed. In their place were pulled three 1-in. pipes which by-passed the oil of the oil-filled cable between the pipe-type cable junction manholes. The oil system of the oil-filled cable was left intact.



Details of How the New Joint is Made

In the partial cross-section above, the cable enters the high-pressure end through a semi-stop gland (1) with a filter by-pass (2). This prevents foreign particles from the pipe system from entering the stress cone area. Cable is terminated with a ferrule and crepe-paper stress cone in a tapered porcelain body. Cap (3) and hood secure the ferrule and confine the high pressure oil (nominally 200 psi) within the porcelain. A 14-in. OD non-magnetic stainless steel casing bolted to the porcelain base partially encloses it.

Oil-filled cable terminates also in a stress cone (4), porcelain (5), ferrule (6), and cap. The porcelain and its steel casing (7) connect to an insulated copper sleeve (8) wiped to the lead sheath of the oil-filled cable. Caps are connected electrically by two four-bolt clamps (9) connected by flexible copper straps (10) and clamped on the hoods. To minimize overall joint diameter, paper insulation and oil are used between the bare copper and the steel casing. This outer insulation is supported by building up the tapered porcelain bodies to the diameter of the caps with crepe-paper tape. Over this taping a ⅛-in. plastic tubing spacer (11) is applied helically with a 2-in. lay. This provides oil passage around the caps and copper straps.

A three-section cylinder covers the taped ends of both porcelains and the area between them and provides foundation for the outer taping. The cylinder consists of lucite sleeves (12) at both ends and a middle copper sleeve (13). For uniform electrical stress distribution in the outer insulation, the copper sleeve is at line potential through contact with four springs (14). Outer insulation build-up is crepe-paper tape, 9 in. in dia in the center with tapered ends.

Center section of the joint is closed by a non-magnetic stainless steel sleeve (15) between the two casings. The sleeve is sealed to the casings with Dresser gaskets and follower ring (16). Split-clamping rings (17) on each casing, joined by long studs, make the joint rigid. To guard against damage to the casings and sleeve, a safety head (18) with a 50-psi rupture diaphram is provided on the sleeve.

Industrial Supply Poses Problems

With growing loads and new processes, utility engineers now face 3 problems:

1. Voltage dips upset automatic processes

2. Lamp flicker can be caused by wide swings in loads of arc furnaces

3. Harmonic resonance from rectifiers can interfere with communications systems

B. L. LLOYD, Electric Utility Engineer, Industry Engineering Department, Westinghouse Electric Corp, E. Pittsburgh, Pa.

Growth of American industry and changes in its processes pose a variety of problems for utilities providing the power. These problems, not all new, are occurring more frequently and in areas previously trouble-free.

Three important problems are:

1. Voltage dips which upset automatic processes.

2. Lamp flicker caused by arc furnaces.

3. Harmonic resonance stemming from rectifier operation.

Increased use of automatic machinery and continuous-process lines has focused new importance on momentary voltage dips. This automatic equipment is usually encountered in new industrial plants in suburban locations.

Such industrial customers are subjected to a larger number of voltage dips because utility circuits in suburban and rural areas are not as well protected as those in a heavily industralized location. Outlying circuits almost invariably have overhead construction and are more subject to faults due to natural and man-made hazards; more concentrated areas often have cable supply circuits.

Automated Plants Are Vulnerable

Automated plants are much more vulnerable to voltage dips than semi-automatic plants. The former have many simple magnetic devices, operated by application of a control voltage, which return to a de-energized position when this voltage is removed.

As these devices are usually fast-operating, a momentary dip in supply voltage has the same effect as interruption of control voltage. With the magnetic restraint removed, springs snap these devices to their de-energized positions. Some devices subject to this condition are contactors, motor starters, control relays, electrically operated valves, and magnetic chucks.

Unexpected tripping of these control devices may cause a complete shut down of a continuous process line such as in paper mills, tinplating lines, or automobile assembly lines. Some lines require considerable time to re-start, and substantial production can be lost. Extensive damage to tools can result from unexpected release of a magnetic chuck, and automatic sequencing equipment can get out of step.

As automation spread across the country, troubles began to develop on utility systems which formerly had few or no complaints from voltage dips. A survey of 47 utilities by the EEI Transmission and Distribution Committee disclosed that 37 have had customer complaints of loss of production or damage to tools or equipment caused by momentary low voltage on the utility system. Twenty-eight companies indicated trouble with motor undervoltage releases on customer equipment; 12 with other motor controls; and a number with automatic tools, furnace controls, mercury lighting, and various other controls.

The most important single control subject to voltage dip is the simple motor contactor. A few years ago contactor drop-out was not recognized as a serious industry problem, and no standards specify a drop-out voltage or time.

Drop-out voltage can range from 30 to 70%, depending on the type-size-magnetic characteristics of the steel, degree of contact between movable and stationary armatures, and other factors. This value can vary considerably among different contactors of the same type and same manufacturer. It can vary also from time to time depending on changes in armature seating and contamination conditions. Drop-out time can be from 1 to 12 cycles, making it difficult or impossible to clear a system fault fast enough to prevent drop out of customer's contactors.

Solution to Voltage Dip Is Not Simple

The solution to this problem is not simple. Modification of control devices to ride through these voltage dips can be expected to increase their cost. Industrial customers generally view this as a utility problem, and usually object to additional expenditures to correct it.

This viewpoint exists because the typical industrial customer has been given such high quality electric service that he has come to expect absolutely constant voltage and frequency where his substation connects to utility lines. This, unfortunately, cannot be accomplished.

Some of the bitterness can be removed from this pill if the power salesman explains to his industrial customers that occasional voltage dips will occur, along with a careful analysis of why these dips cannot be avoided without tremendous increase in rates. This explanation should be given before a new plant goes into service and mentioned from time to time even though no trouble develops. The aftermath of a disturbance is less unpleasant if warnings and explanations have been given beforehand.

One solution which has been attempted is use of latched-in control relays, but this may present some safety hazards. Constant-voltage transformers or even motor-generator sets may prove applicable for specific problems.

Yet, this remains an industry-wide problem which will increase in importance with the spread of automation. The ultimate solution to the problem must ultimately come from concerted industry attention. Only

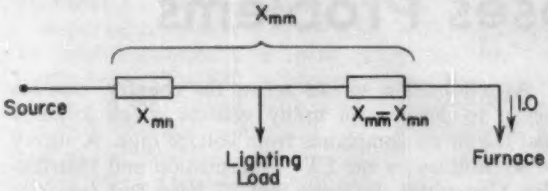
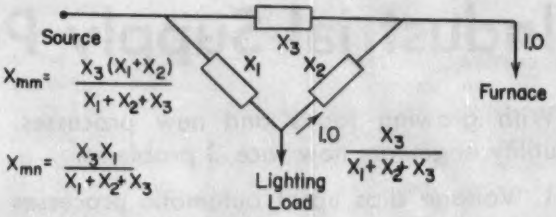


FIG 1—ARC-FURNACE SUPPLY can be designed with help of X_{mn} drop from generator internal voltage to closest lighting load with furnace transformer drawing nameplate kva. Derivation is for radial (left) and loop circuits



development of appropriate standards for the control devices can solve the problem.

Arc furnace use has increased steadily over the past years with greater demands for high-grade alloy steel. The size of these furnaces has steadily grown, with a number of 25,000-kva units in service and larger ratings being discussed.

Arc furnaces are usually considered desirable loads because of high load and power factors during the refining operation. But wide load variations, particularly during meltdown, make this load difficult to supply because of objectionable voltage fluctuations and lamp flicker.

Prediction of the frequency, magnitude, and power factor of load swings for a contemplated furnace installation is quite difficult. Many references on this subject use the short-circuit capability of the bus supplying the furnace transformer as a yardstick for judging the adequacy of the supply system. This yardstick is valid only when the nearest lighting load is connected to the bus supplying the furnace transformer.

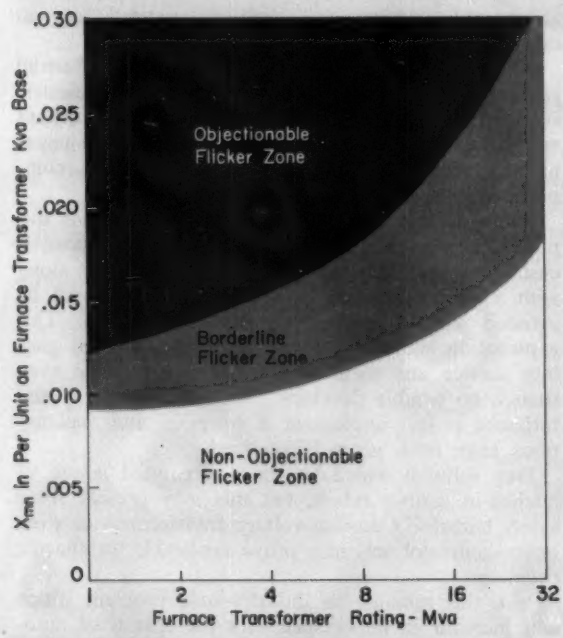


FIG 2—FIRST STEP in designing supply system for new single furnace is determining the permissible values of X_{mn}

The report of an AIEE subcommittee (AIEE TP 57-9) introduces a new quantity which serves as a suitable yardstick, regardless of the location of the nearest lighting load. This quantity, designated X_{mn}, is defined as the voltage drop from the internal voltage of the system generators to the closest lighting load when the furnace transformer is drawing nameplate kva. Voltage drop to the furnace transformer bus is designated X_{mm}. The self and mutual drop coefficients (X_{mm} and X_{mn}, respectively) are illustrated in Fig 1 for two system configurations.

Flicker voltage at the lighting load is proportional to X_{mn} for a given load swing at the furnace, and flicker voltage at the furnace bus is proportional to X_{mm}. Hence X_{mm} (or short-circuit capacity) is of little importance unless the lighting load is tapped directly on the furnace transformer bus.

Limits of X_{mn} as obtained from the subcommittee report are drawn as smooth curves in Fig 2. These curves are helpful in comparing the performance of existing installations and as the first step in engineering the supply system for a new installation.

However, there are indications that arc furnaces above 15,000 kva, operating at electrode voltages above 400 v, can exhibit a "cyclic flicker" which is not observed to a major extent in smaller furnaces. This phenomenon may lower the permissible values of X_{mn} for large furnaces. Data compiled by the subcommittee did not permit evaluation of "cyclic flicker" and hence should be applied cautiously for larger furnaces.

Removing Flicker Trouble Is Costly

Engineering a satisfactory electrical supply system for an arc furnace installation can still not be described as a rigid science. If flicker trouble is indicated, the solution will probably require either stiffening the supply system or installing synchronous condensers and buffer reactors. Both methods can be very costly, even for a few tenths of a volt reduction in flicker.

Growth in aluminum, chemical, paper, and similar industries has increased the demand for direct current. Economics usually dictate that these plants be supplied from the utility ac system with conversion equipment on the customer's property. If dc requirements are large, this conversion is usually accomplished by means of mercury-arc, static, or mechanical rectifiers. Such rectifiers can generate an abundance of harmonic currents.

The effect of these harmonics is aggravated by extensive use of shunt capacitor banks at industrial substations for power factor correction.

Harmonic currents generated by the rectifier are fed outward into the connected system. The power system usually has the approximate appearance of an equivalent series reactance to some infinite bus or internal generator voltage. But the capacitors provide a parallel circuit which becomes resonant with the system reactance at some frequency, making the "looking back" impedance very high as viewed from the rectifier.

If substantial harmonic current is generated by the rectifier at or near this resonant frequency, high harmonic voltages appear at the rectifier and high harmonic currents circulate in the resonant "tank" circuit.

The harmonic voltages will probably not cause much difficulty. But the circulating harmonic currents can cause serious interference with nearby communications systems and overheating of the capacitors. In at least one case where the resistance of the external system was quite low, the harmonic current tripped overcurrent relays on the capacitor bank.

Resonance Trouble Occurs Infrequently

Resonance trouble occurs rather infrequently because the circuit is seldom resonant at the particular frequency at which a substantial amount of harmonic current is generated. Harmonic current decreases as the order of the harmonic increases. There are no even harmonics and the lower orders of odd harmonics are frequently suppressed by the rectifier transformer.

For example, with a 12-phase rectifier the 11th harmonic is the first encountered in substantial magnitude; for a 24-phase rectifier, the first harmonic encountered is the 23rd. The magnitude of these higher order harmonics is so small that the external circuit and the capacitor bank must be in almost perfect resonance and the system resistance very small to encounter serious trouble.

Corrective measures may be required in cases where the resonant frequency is close to that of a harmonic current of substantial amplitude. The equivalent circuit is shown in Fig 3.

The ratio of harmonic current supplied to the external system (i_s) to the harmonic current generated by the rectifier (i_h) can be easily calculated and plotted. Then when the value of i_h for each harmonic is determined for the partcular dc load, transformer connection, firing angle, and other factors, the value of i_s can be calculated.

Equivalent reactance of the external system will vary during the day and from weekday to weekend because of the line and generator switching. Hence harmonic current conditions must be analyzed for the range of system reactances normally encountered. Operating conditions of the rectifier which will give the maximum value of harmonic currents should be used in these analyses.

How to Alleviate Resonance Trouble

Resonance trouble may be alleviated in several ways. One is shifting the resonant frequency, by adding more capacitors, to a harmonic which is suppressed by the transformer connection. This is particularly desirable for the industrial when the capacitors will largely pay for themselves in savings on demand charges.

Sometimes the utility can rearrange the supply circuitry to shift the resonant frequency to a less objectionable harmonic. This is often undesirable to the utility because it usually costs money and sacrifices operating flexibility for supplying other customers. But, in some cases a change in supply circuitry can be accomplished easily and satisfactorily.

A more universal solution is to install a reactor in series with the shunt capacitor bank with its inductance selected to cause series resonance at the frequency of the troublesome harmonic. For example, all seventh harmonic current generated by the rectifier would be short circuited by a shunt filter comprising a reactor with a 60-cps reactance of 1/49th of the capacitor's 60-cps reactance.

Variations in system configuration which cause resonance at more than one troublesome harmonic, may require a separate shunt filter to eliminate each of the troublesome harmonics. This can usually be done by splitting the capacitor bank into sections and connecting a reactor in series with each section, each to eliminate a different harmonic current.

Adding reactance in series with the capacitor bank raises the 60-cps voltage across the capacitors. The maximum voltage rating of the capacitors should not be exceeded.

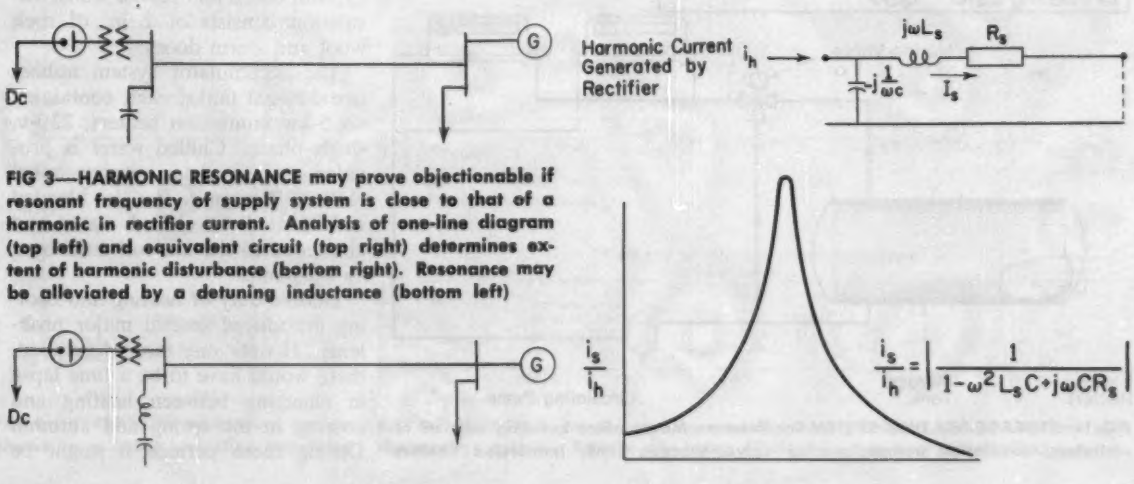


FIG 3—HARMONIC RESONANCE may prove objectionable if resonant frequency of supply system is close to that of a harmonic in rectifier current. Analysis of one-line diagram (top left) and equivalent circuit (top right) determines extent of harmonic disturbance (bottom right). Resonance may be alleviated by a detuning inductance (bottom left)

Water Stored Off-peak Can Heat and

J. M. TURNBULL, Director, Area Development Department;
G. C. JAMISON, Industrial Consultant, Western Massachusetts Electric Co, Springfield, Mass.

Electric space heating and cooling with accumulator-type storage systems offers promise as a desirable controlled load for utilities. Studies by Western Massachusetts Electric Co of an office and two home installations indicate that this system, based on nighttime storage of hot and cold water, can give occupants year-round comfort at reasonable cost.

The two residential installations were planned to encourage manufacturers to produce applicable equipment, to acquire working knowledge of storage systems, and to secure economic data. Results show that heating-and-cooling storage systems, developed to an economically operative stage, will find a place in the trend toward the all-electric home.

Utilities will find such storage systems a boon because their electrical load can be diverted to off-peak periods. Heat is released from the storage system at a time determined by the building's heat loss and stored in the system at a time favorable to the utility. This means that a minimum of capital investment is needed for the utility to supply this new load.

The first storage heating installation by Western Mass., made in 1929 at one of its office buildings (EW, Jan. 31, 1931), has operated successfully for 28 years. The building is constructed of concrete and steel, with an exterior finish of face brick and 4 in. of rock-wool insulation in the ceiling. It is a 70 by 110-ft single-story and basement structure containing 102,400 cu ft of heated space.

Main elements of the building's storage system are a radiation system, circulation pump, mixing valve, and storage tank containing electric immersion heaters (Fig 1).

Water in the storage tank is heated to 250F at 15 psig during the nighttime off-peak hours. This 250F water is blended at the mixing valve with recirculated water, and the resulting mixture is circulated at 180F through a conventional radiation system. By using fan-coil type convectors in the radiation system, the circulating water temperature could be lowered to 120F, permitting the use of a smaller storage tank.

The heated area is zoned, each zone served by a branch header in which there is a control valve operated by a room-type thermostat in that zone. Operation of the circulating pump supplying the branch headers is continuous.

How to compare the operating cost of storage heat with other forms of heating is a controversial question. First, it is necessary to assume an efficiency for imaginary fuel-fired systems. Then, an electric rate must be assumed, as Western Mass. has not yet developed a rate structure for this type of load.

During the 20-year period from 1930 to 1950, Western Mass. found the average annual kwhr consumption of this storage system was 231,217. Total degree days averaged 6,878. This meant that kwhr per degree day per 1,000 cu ft averaged 0.328. These data were used for a fuel cost comparison for 1953-54, and results showed that the storage system was only slightly more expensive than oil or gas. But with further developments, storage heating can become as economical to the user as other forms of heating.

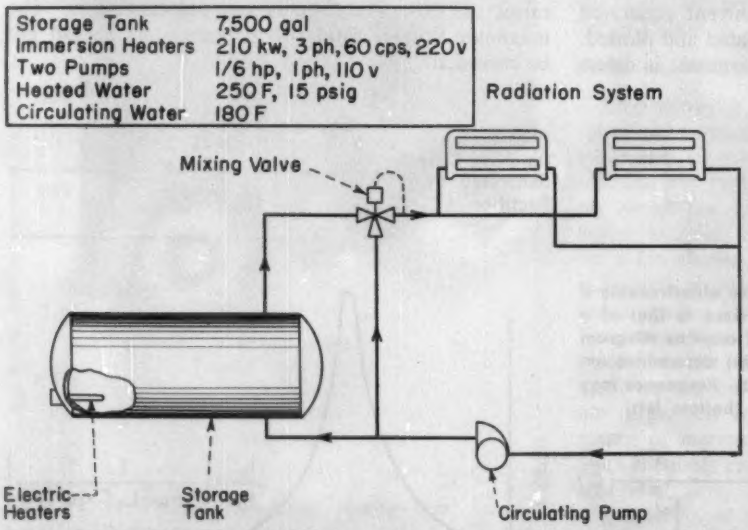

Storage Tank 7,500 gal
Immersion Heaters 210 kw, 3 ph, 60 cps, 220v
Two Pumps 1/6 hp, 1 ph, 110 v
Heated Water 250 F, 15 psig
Circulating Water 180 F
Radiation System
Mixing Valve
Electric Heaters
Storage Tank
Circulating Pump

FIG 1—STORAGE-HEATING SYSTEM for Western Mass., office building consists of radiators, circulation pumps, mixing valve, storage tank, immersion heaters

Problems Encountered

Because the results of this experimental heating installation were encouraging, the company decided to undertake both heating and cooling of two test residences by the storage system. The first residence chosen was a two-bedroom, single-story house occupied by two persons. It is 24 by 32 ft, with a living room wing 13 by 22 ft. Total heated volume is 7,905 cu ft. Construction is wood frame and shingle with gypsum board and plaster walls. Insulation consists of 2 in. of rock wool and storm doors.

The accumulator system utilizes two 530-gal tanks, each containing six 5-kw immersion heaters, 230-v, single-phase. Chilled water is provided by a 3-ton water-cooled chiller. Return water is blended with heated or chilled water and circulated to the fan-coil units by a ⅛-hp pump.

Double duty of heating and cooling introduced several major problems. If only one tank were used, there would have to be a time lapse in changing between heating and cooling in the spring and autumn. During these periods it might be

Cool Space

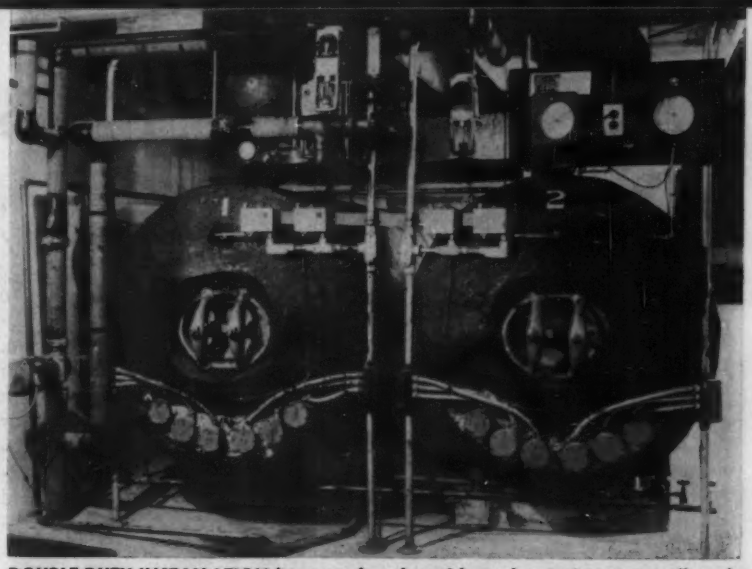
desirable in a single day to heat the house in early morning and cool it in late afternoon. To cope with this problem, two storage tanks were installed. One will be heated and the other cooled each night during spring and autumn.

Dual purpose insulation (heating-cooling) of accumulators, equipment, and piping requires special consideration and can become expensive. Results of these tests indicate that, for heating duty only, a 300-gal storage tank would be adequate for residential applications.

The radiation system uses units containing a finned coil and blower. For heating, the water is circulated at 120F; for cooling, at 55F. During the heating season the stored water is heated each night to 250F; during the cooling season, the water is chilled each night to 35F.

To test fully the versatility of the system, several patterns of off-peak heating were employed. Fig 2 shows various operating conditions in which demand and charging time were changed over a wide range.

In the coldest part of January this year the house was satisfactorily heated by the storage system (Fig 3). Different off-peak night loads were tried, and it was found that the design of the charging cycle had no effect on the ability of the system to heat the house, as long as the accumulators contained enough heat at the end of the charging period to carry over the non-charging period. Thus, the utility can serve the space-heating load, which by its very nature is random, with controlled blocks of energy patterned to fit load-curve valleys.



DOUBLE-DUTY INSTALLATION heats and cools residence by storing water off-peak. System uses two 530-gal tanks, each containing six 5-kw immersion heaters

Experiments Checked

To check the results of these experiments, a second residential storage installation was made. It differs in certain respects to permit evaluation of such aspects as number of occupants, use of insulating windows, type of construction, and air-cooled vs water-cooled chillers.

Based on these findings, a third residential job now underway calls for heating initially and chilling ultimately. It will utilize one 300-gal accumulator and a central water-air heat exchanger with ducts to each room.

These installations are part of a space-heating test program undertaken by Western Mass. to study and evaluate the economy and effectiveness of various means of electric space heating. Test data are also being taken on heat-pump and resistance-wire installations.

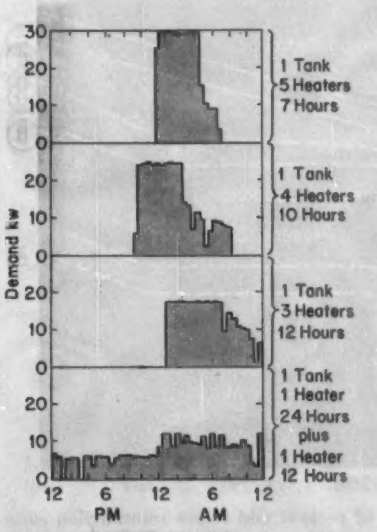


FIG 2—VERSATILITY of heating system shows up in many operating schedules

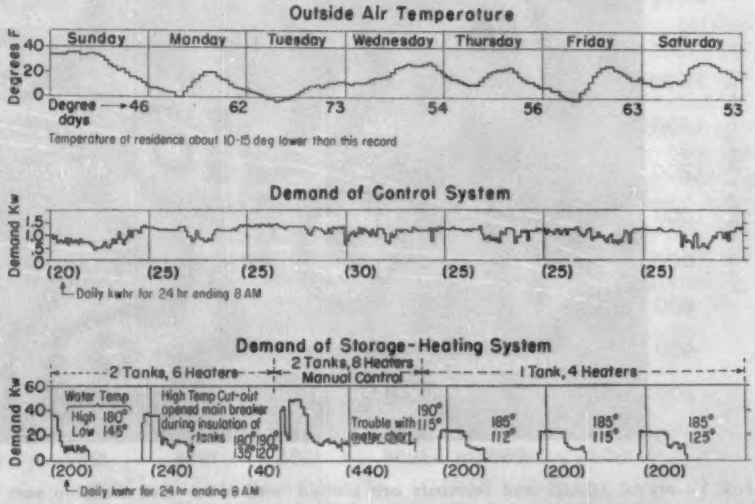


FIG 3—RESIDENCE was heated successfully during coldest part of January by the storage system. Results are being checked in two new installations

Plan 5 Years Ahead for System

Union Electric forecasts requirements 5 years ahead, determines firm and other economic sources of supply

V. J. FARMER, Electrical Engineer,
G. S. WHITLOW, Planning Engineer,
Union Electric Co, St. Louis, Mo.

System var supply is growing in importance because of higher summer loads and greater transmission distances. Var supply is enhanced by the lower relative cost of capacitors and improved control equipment. Supply of system vars should be planned as carefully as system watt supply, giving proper consideration to the various sources —generators, synchronous condensers, and primary and secondary capacitors. It is the authors' experience that a clear picture of system var requirements and how they will be met is needed about 5 years ahead.

Some phases of var planning which affect system design should be advanced more than 5 years. Future generation and transmission cannot be planned adequately without decisions as to distribution and bulk station power factors that are to be maintained. The role of switched capacitors in regulating voltage must be known before regulation methods for future distribution substations can be chosen.

Var supply planning begins with forecasts of future loads. Data should include peak watt and var loading for recent years on generators, synchronous condensers, transmission substations, feeders, and bulk customers. Quantities of capacitors in service must be known. This information should be localized by substation area. As forecasts require adequate data, the planner should promote var metering.

Watt Load Forecast

Forecasts of watt load growth are the next requirement, along with plans for future generation, transmission, and bulk substation additions to the system and interconnected systems. The var planner then determines which areas must be largely self-sufficient in var supply because of high impedance between areas. Area independence is necessary so that loss of a transmission line or a generator will not cause unduly low voltage or handicap watt transport to the area.

Var load peaks for past years are determined by totaling var output of generators, synchronous condensers, capacitors and charging vars of high voltage lines and cables. Var outflow to other systems is deducted from total var supply; var inflow from other systems is added to get the total system supply. Gross var peaks are related to corresponding watt peaks, as shown at the left in Fig 1. Then the basic system power factor for each year is computed. Power factors of annual load growths, although they may be erratic, provide a more sensitive indication of power factor trends than total load power factors.

In determining the power factors of future load growths, characteristics of loads expected must be considered. Loading on lines and transformers which may increase or decrease the proportion of var losses should be examined also. Var growths are calculated for the future on the basis of estimated growth power factors and forcasted watt growths.

If sufficient var load data and a network analyzer are available, an alternate method is to separate gross

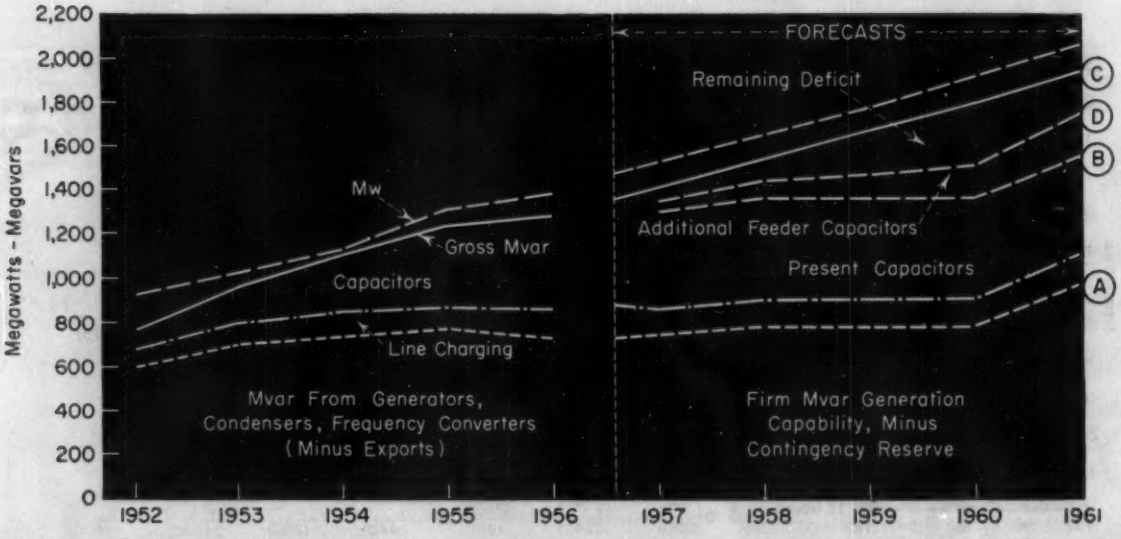


FIG 1—MVAR LOADS and forecasts are plotted with Mw for Union Electric system. To meet predicted gross Mvar loads (C), firm Mvar generation is shown by (A). Capacitors and charging vars of present and future transmission raise Mvar supply to (B), and feeder capacitors to (D). Remaining Mvars come from other sources as found economical

Var Supply

vars into: 1. "Loss" vars in transmission lines and major transformations, and 2. "Load" vars including distribution system losses. "Basic" and growth power factors are computed and future growth factors are estimated for the "load" portion only. Future gross "load" vars then are calculated.

Predicted watt and var loads are distributed among the major load centers, and the extent of capacitor application is estimated for each. Transmission var losses are determined with a network analyzer. They may be computed if the transmission system is not too complex. But an analyzer gives var losses and suggests how they may be reduced. If system generation schedules and line loadings vary seasonly, maximum losses may be found. Future gross vars are determined by adding estimated growth vars to past peak load vars.

Expected Deficit Found

With var requirements estimated, available var supply is determined to find the expected var deficit. Var supply from rotating equipment may be determined from generator capability curves. Only var capability at full watt loading should be used. Although steaming capacity may be less than total watt capability of machines, and some var capacity will be available, total var capability of all generators and synchronous condensers cannot be considered available at peak load.

A reasonable var reserve should be established, such as the capacity of the machine with the greatest var capacity. An additional contingency allowance should cover such factors as: 1. Theoretical var generating capability of doubtful availability under contingency conditions; 2. Increased line and transformer losses due to abnormal contingency loading; 3. Var requirements to import emergency power from interconnected system; 4. Incomplete var data.

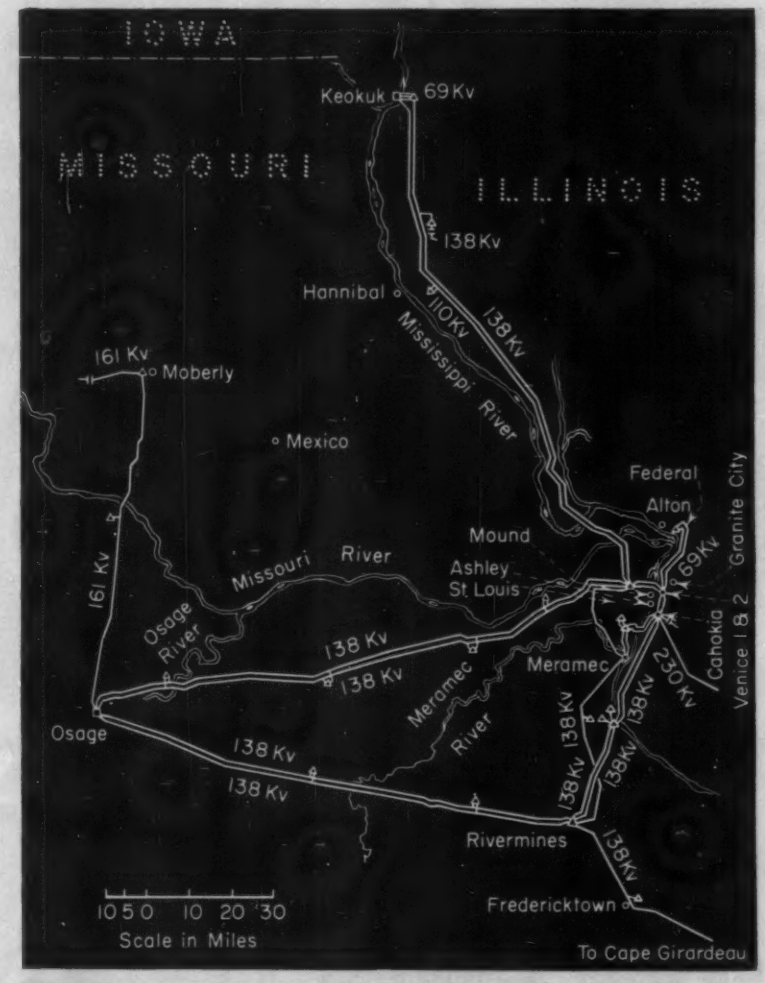
For the Union Electric system, var generating capacity minus the selected contingency reserve with the largest unit out of service is shown by (A) in Fig 1. Existing capacitor vars and charging vars of present and future transmission lines were added to obtain (B). Difference between (B) and the predicted gross var loads shown by (C) represents annual var deficits.

The first step in meeting var deficits is the installation of fixed and auto-switched, pole-mounted capacitors on distribution feeders. In planning these additions, the desirable power factor may be questionable. Studies indicate that distribution system power factors of 97% or higher are justified economically. A capacitor program with a reasonable chance of being accepted and accomplished should be planned.

Planned distribution system capacitor vars are deducted from var deficits. As shown in Fig 1, this leaves a remaining deficit between (C) and (D). To help meet this deficit, residual var loads among major load centers are calculated. Favorable sites at distribution substations, bulk substations, bulk customers, and transmission switching stations are selected. Special attention should be given to approaching substation or line overloads or low-voltage conditions. Capacitors may alleviate these conditions or defer investments for new capacity.

Factors Employed

Capacitor vars for each location are determined by the maximum and minimum vars present, voltage correction needed, value of kva capacity released, and the value of watt-loss and var-loss reduction. To



LONG TRANSMISSION LINES and growing summer loads on the Union Electric system are reasons why company var planners forecast needs five years ahead

satisfy emergency var requirements, capacitors above normal needs may be installed at bulk power centers. For less critical situations, var generation capability may be provided by generators with lower power-factor ratings. Benefits of more capacitors on the transmission and distribution system should be evaluated before the above steps are taken. The resulting var supply plan should be checked, a network analyzer determining whether var supply for each area is adequate under significant operating conditions and contingencies; whether voltage is adequate at critical points; and if var generating capabilities can be used.

Cost About $6 Per Kvar

Fixed primary capacitors on poles, at about $6 per kvar, are second only to generator vars in cost and provide near-maximum benefits. Only secondary capacitors, nearer the load, provide greater benefits. Fixed capacitor vars are limited to the minimum var load. With leading power factor there may be high-voltage difficulties and generator stability margins will be reduced. Pole-mounted, secondary capacitors, costing $16 to $20 per kvar, may be justified by the released capacity, loss reduction and voltage improvement on primary mains, transformers, and secondaries.

Offers Same Benefits

Switched primary feed capacitors, costing $8 to $9 per kvar or more, offer the same benefits as fixed capacitors, plus voltage regulating ability. Capacitors on distribution substation buses cost $9 to $10 per kvar but provide less benefits than those on primary feeders. Substation capacitors should be considered only when feeder capacitors cannot be applied.

Capacitors on bulk substation buses cost $9 to $10 per kvar for large banks and may be justified by the combination of residual var loads from distribution substations, bulk customer loads, and var losses in transmission and subtransmission lines and transformers. Voltage benefits under contingency conditions may be important.

Capacitors at bulk customer loads may cost about the same as substation capacitors, but, installation and maintenance are often difficult.

Synchronous condensers at bulk substations cost about $20 per kvar installed in large sizes. Operation and maintenance costs and losses will be much higher than for capacitors. Extra costs may be justified by ability of condensers to provide stepless adjustment of var output and voltage control, to absorb vars, and to maintain or increase var output during system disturbance.

Additional var supply from generators costs about $4 per kvar including additional transformation costs, but unlimited var supply by generation affects slightly the optimum economic system power factor. A formula for economic application of capacitors, evaluating only released kva capacity, is:

$$\frac{\text{Capacitor cost per kvar}}{\text{Incremental cost of system kva}} = \sin\theta$$

where $\sin\theta$ = economic reactive factor

$$= \sqrt{1 - (\text{economic power factor})^2}$$

Incremental cost of system capacity, as affected by reduction of power factor, is difficult to determine. If $40 per kva is selected, with capacitors at $8.50 per kvar, an economic power factor of 97.7% is indicated. If the power plant component of cost is omitted ($5 per kva for lower power-factor generators), economic power factor will drop to only 97.0%. Efforts to obtain maximum var supply from generators may not be justified, but a liberal var reserve in generators will be beneficial under contingency conditions.

Costs Up, Benefits Down

As var supply location progresses from fixed primary to bulk substation, costs increase and benefits decrease. Thus full use should be made of each type, consistent with its inherent limitations, before proceeding to the next least costly type.

One factor that limits capacitor additions is generator instability due to low excitation during periods of leading power factor. Another type of instability from high levels of capacitor application is that of the system disturbance which would cause a severe slump in voltage. The seriousness of this stability hazard is problematical, although there appears to be no record of system breakdown due to this cause. High voltage during light-load periods is another limitation on the installation of capacitors. It can be overcome by switching off part of the capacitors after the load peaks.

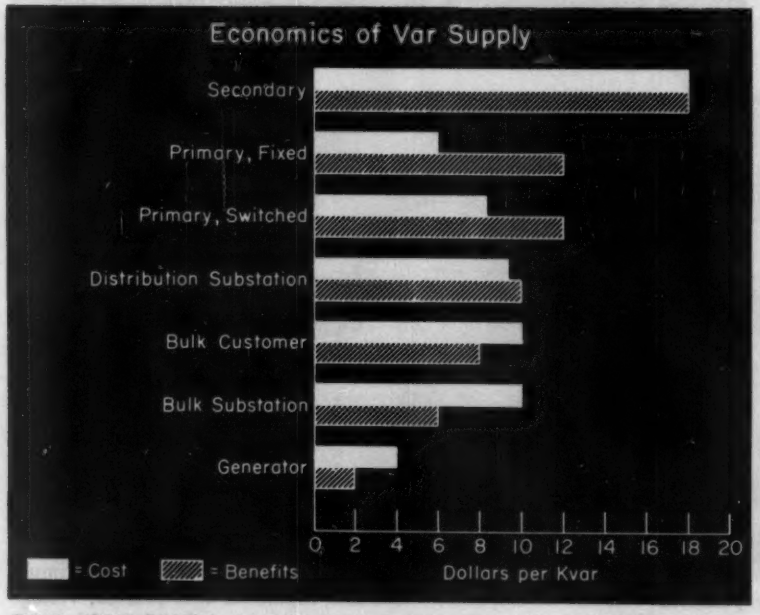
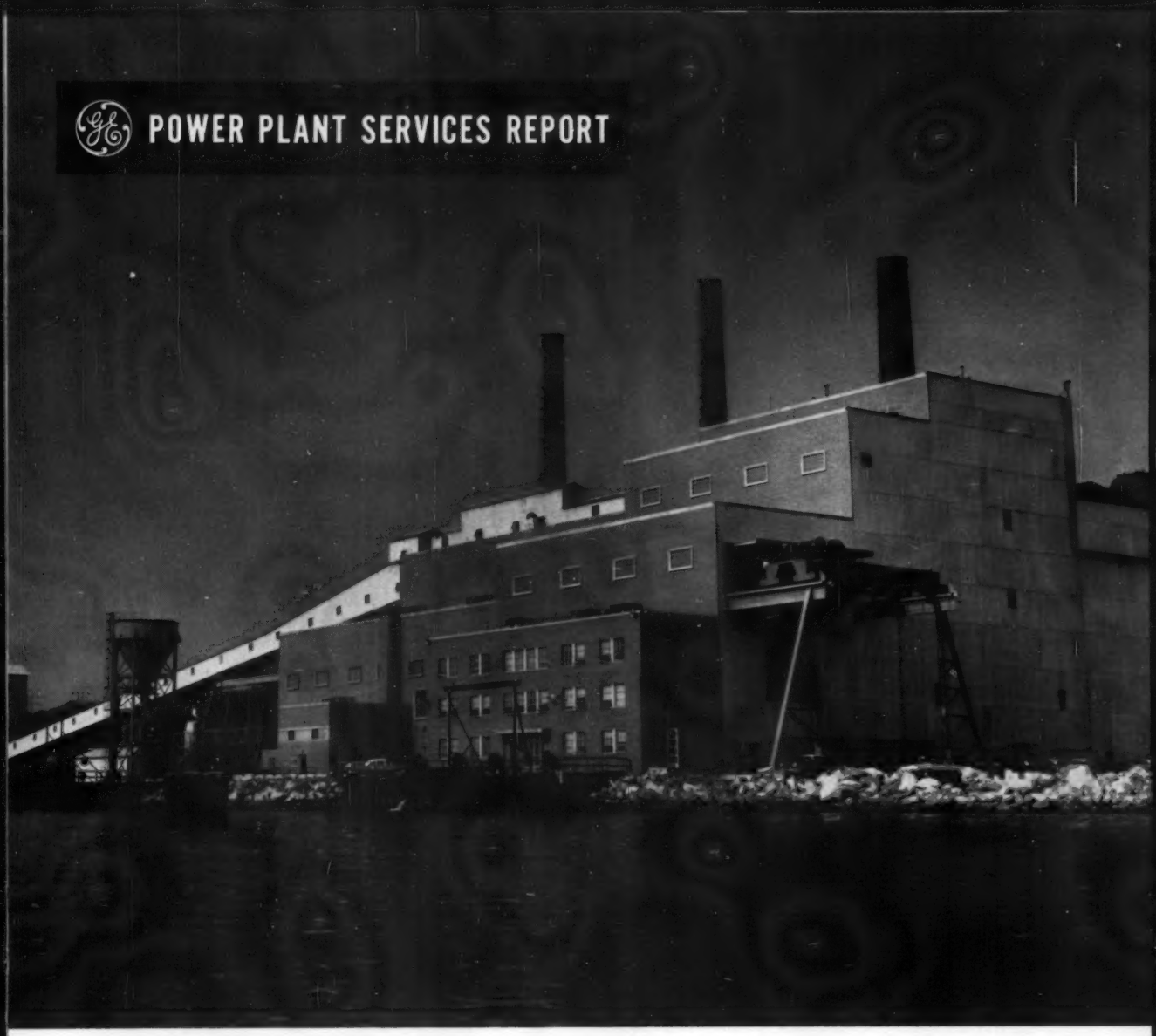


FIG 2—KVAR COSTS and benefits indicate full use should be made of each var source before the next least costly source is applied to the utility system

POWER PLANT SERVICES REPORT



Rockland Light and Power meets area's growth with 3rd General Electric unit at Lovett Plant

Rockland Light and Power Company's load has increased an average of 12% per year since 1949. This enviable growth was stimulated largely by the completion of a network of superhighways that crisscross the utility's service area in Southeastern New York State. Drawn by excellent transportation to and from New York City, thousands of New York commuters and businessmen built new homes and started new operations in the area. The result has been a rapid yet balanced increase in Rockland's residential, industrial, and commercial load.

Rockland engineers had forecast this challenging growth and planned steps to stay well ahead of generation requirements. Their latest step was the addition of a third General Electric steam turbine-generator unit—rated 66,000 kw—to Rockland's Lovett Plant. By specifying General Electric equipment, the utility and its consultant, Burns & Roe, benefited from General Electric Power Plant Services . . . saving time, money, and manpower.

FOR MORE DATA TURN PAGE▶

MORE POWER TO AMERICA

GENERAL ELECTRIC

POWER PLANT SERVICES REPORT

EARLY PLANNING made installation of G-E 3500-amp, 15-kv isolated phase bus duct a smooth operation. L to r, I. F. Conklin, Plant's Ass't Chief Engr., and R. W. Brown, G-E Installation Engr.

Engineering teamwork of Rockland, and General Electric boosts system

Application, design, manufacture, delivery of apparatus . . . all synchronized with plant's progress . . . eliminated costly delays

Long-range planning to meet load growth is readily apparent at Rockland Light and Power's Lovett Plant. The first unit in the Lovett Plant—a General Electric, 22,000-kw steam turbine-generator—went on the line in 1949, and a similar machine was added in 1951. The steaming of unit No. 3 raised over-all system capacity to 172,000 kw—enough to satisfy predicted peak loads as far ahead as 1961.

As work on unit No. 3 progressed, the many benefits of designating one manufacturer to co-ordinate equipment design, manufacture, delivery, and installation became clear. From preliminary design stages to start-up, the General Electric Power Plant Services team assigned to the project gave vital assistance in meeting construction schedules and keeping costs down. And utility and Burns & Roe engineers, freed from piecemeal expediting, were able to concentrate on the Plant's other important phases.

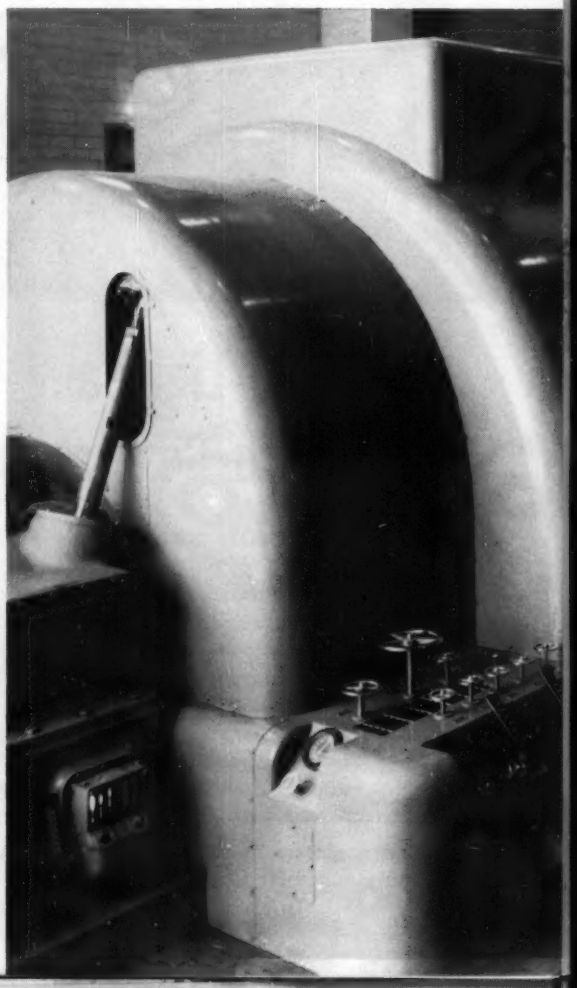
The Lovett Plant installation exemplifies the type of assistance you get from General Electric Power Plant Services when you specify General Electric apparatus. These services consist of application engineering, field service engineering, product development engineering, and power plant co-ordination engineering which help to:

- SIMPLIFY ORDERING OF EQUIPMENT
- CONSERVE ENGINEERING TIME
- INTEGRATE EQUIPMENT DESIGNS
- SPEED PLANT CONSTRUCTION
- ASSIST IN TRAINING OPERATORS

For full information on Power Plant Services, contact your General Electric Apparatus Sales Office or write for 28-page bulletin GEA-6320 to General Electric Company, Section 302-19, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC



ENGINEERING TIME WAS SAVED for utility and consulting engineers when G.E. assisted in the job of specifying and ordering equipment—as with this 2400-volt, 1200-amp, metal-clad station auxiliary switchgear being examined by (left) Lovett Plant's Chief Engr., D. S. Bailey and G-E Application Engr. C. B. Wilson.

Burns & Roe, capacity 70%

REDUCED CONSTRUCTION COSTS resulted from integrated design and installation of G-E steam turbine-generator and unique condenser design by Burns & Roe in which condenser shell served as turbine's foundation. L to r, G.E.'s E. R. Cotton, N. Y. Utility Sales Mgr.; C. L. Hulswit, Pres., RL&P; and Ralph Roe, Pres., B&R, discuss 66,000-kw, 3600-rpm, tandem-compound, double-flow reheat unit.

ON-TIME DELIVERY of G-E Type FOA-T, 84,000-kva power transformer was expedited by B&R—G-E shipment schedule. L to r, G-E Sales Engrs. W. West, E. F. Thrall; and RL&P V. Pres. L. E. Merrow.

OPERATORS ARE TRAINED by G-E engineers during installation to get maximum effectiveness from equipment. Here, Foreman R. Favre switches load at G-E 1000-kva, 480-volt, load center unit substation.

FOR MORE DATA TURN PAGE▶

ADVANCE PLANNING of Lovett Plant's equipment requirements by Burns & Roe and G-E engineers kept installation on schedule, avoided costly delays. At B&R's New York offices are, l to r, J. Segall, B&R Electrical Engr.; R. B. Davis, G-E Sales Engr.; D. H. Kregg, B&R Project Dir.: A. J. Fiehn, B&R Mech. Engr.; C. B. Wilson, G-E Application Engr.

General Electric power plant service engineers help speed apparatus installation, reduce costs

Co-operative engineering between utility, consultant, and manufacturer made the addition of unit No. 3 to Lovett Plant a smooth, on-schedule operation. The early conferences between General Electric application engineers and Burns & Roe engineers helped Burns & Roe design and construct the most efficient station for Rockland's needs.

When manufacturer and consulting engineer get together at such a planning conference, a great variety of highly specialized skills is brought to bear on deciding how to build maximum effectiveness and flexibility into your power station. For the manufacturer's contribution to this planning, General Electric assigns a staff of engineers representing many years' experience in providing General Electric Power Plant Services.

As requirements in power station equipment advance to higher ratings, improved efficiencies, and even greater reliability, the advantage of selecting General Electric apparatus, combined with time-saving General Electric engineering teamwork, offers electric utilities increasing reason to call in General Electric early when planning a new station. 202-19

MORE POWER TO AMERICA

GENERAL ELECTRIC

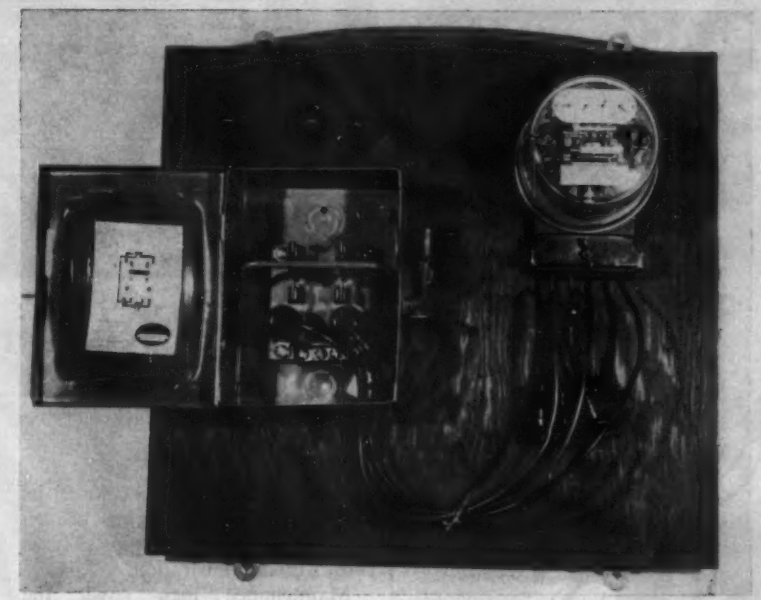
Temporary Test Meters Installed Quickly

METERING—Testing

JOSEPH J. WOLKAN, Ohio Power Co, Canton, Ohio

Tests of the kwhr consumption of water heaters, driers, and small appliances must be made often in customer's homes. There are at least two ways to make such tests without disturbing the customers' wiring or using too much time for setting up the test equipment.

In both methods, the kwhr test meter is mounted on a plywood panel that can be hung or placed adjacent to the customer's appliance circuit switch, so that the dummy fuse terminals of the meter leads may be connected in the switch box. Such connection gives the proper meter registration.



CUSTOMER'S SWITCH installed for a water heater or drier. The weatherproof sockets attached to meter's left leads contain renewable 30-amp plug fuses

Tests Plug-fuse Setup

The weather-proof sockets adjacent to the test meter contain 30-amp, 250-v renewable fuse plugs.

The first method is for test connections to a switch box containing plug-type fuses. The fuses are temporarily replaced by the dummy fuses at the ends of the meter leads.

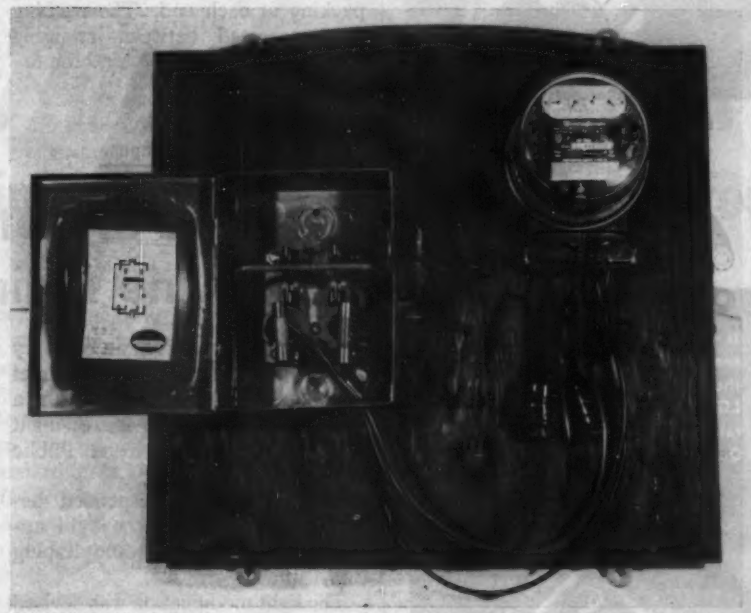
The dummy fuses are swivel attachment plugs without links, and the red meter leads are connected to the plug tips to assure proper meter connections.

Tests Cartridge Fuse

The second method is for test connections to a switch box having cartridge fuses. The fuses are temporarily replaced by the dummy fuse cartridges at the ends of the meter leads. The dummy fuses are standard 30-amp, 250-v renewable fuse cartridges without fuse links and having two holes drilled near the caps for the red and black meter.

The leads are soldered to the insides of the caps. Proper connections of the meter are assured by inserting the dummy fuses with the red wire on the line side of the fuse block.

Meter leads from the dummy fuses can be fished through an insulating bushing in the switch box.



DUMMY FUSE TERMINALS of meter leads temporarily replace cartridge fuses during test. Dummy fuse is standard 30-amp 250-v cartridge without fuse links

After the leads and bushing have been removed, the knock-out hole is closed by any of the means provided for this purpose.

The equipment enables testers to make test connections in half the customary time, and the test set can be used indefinitely without additional material. Exclusive of the meter, materials cost less than $3.

(*More How To on page* 76)

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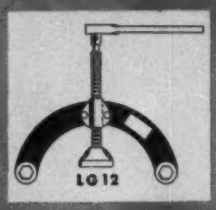
SLACK PULLER

For pulling slack in a messenger you need a man with the strength of Hercules, the ruggedness of Atlas, the speed of Mercury . . . or a Little Giant Slack Puller.



If you need to pull slack in a messenger for any reason, either of the Little Giant Slack Pullers, the LG1 slip handle or the LG12 ratchet handle will do the job Quick, Easy and Safe.

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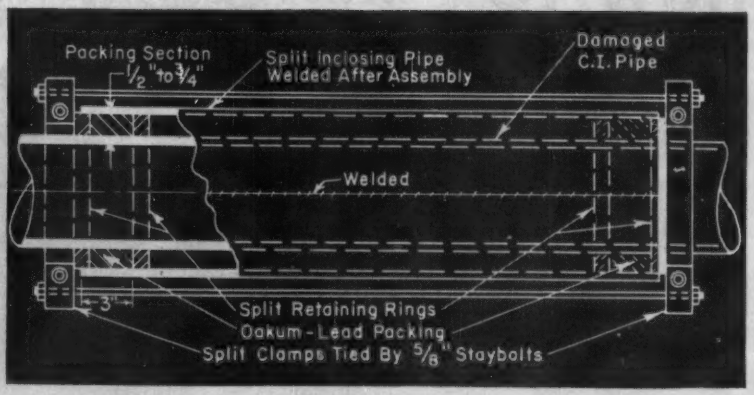

C.I. Pipe Repairs Simplified

J. B. OSBORN, Pipe Maint. Foreman, Windsor Plant, Beach Bottom Power Co, Power, W. Va.

Windsor Plant has developed its own method of repairing broken sections of cast-iron pipe. It is shown in the illustration.

Maintenance men cover the broken area with an oversize, enclosing pipe which has oakum-lead packing at each end. The packing is compressed between retaining rings by split clamps around the defective pipe and tied by stay bolts. The enclosing pipe is larger in diameter than the damaged pipe to provide packing glands. To allow assembly the enclosing pipe is halved lengthwise, and to each half, about 3 in. from each end, are welded split retaining rings.

After assembly, the enclosure is welded along longitudinal joints. With the exception of the welding operations, any repairman can fabricate the parts. The repair is usually permanent.

DISTRIBUTION—Maintenance

Adapted Street Light Speeds Night Line Maintenance Work

A light adapted from an ordinary 20,000-lumen mercury vapor street lamp and mounted vertically on a four-legged steel stand makes night repairs easier for Arizona Public Service linemen.

A 30-lb ballast suspended between the legs keeps the light upright and serves as a multiple-plug transformer.

The light modification was devised by Marlin J. Jarman, distribution and construction supervisor in the Phoenix division.

Simple to Construct

The portable, light-weight device lights up power lines 60 ft in the air while illuminating a large ground area. Lights used formerly either illumined too small an area or were so bright that they blinded workers.

Advantages of the new light are simplicity of construction, low expense, ease of vision and transportation, and low-voltage operation. Its three sections—mercury vapor lamp, stand, and combination ballast-transformer—are detachable. The range of the light is controlled by a lever which raises or lowers the lamp face. A revolving pivot provides full swing in any direction. The entire assembly weighs less than 75 lb.

Jarman has estimated the construction cost to be about $50, exclusive of the price of the mercury vapor lamp.

(*Continued on page* 77)

INCREASED SAFETY with enclosed bus bars, unique trolley arm Safety-Slot.
FAST, COST-REDUCING INSTALLATION with longer, lighter track sections.

DEPENDABILITY ASSURED—strong aluminized steel housing, rugged petticoat insulator, husky trolley components.

New *LEC-TROL-FEED* System

for fast-action installation—safety-first power

This new, preassembled LEC-TROL-FEED conductor system gives you outstanding advantages for supplying electric power to cranes, hoists, welding units and other straight-runway equipment.

LEC-TROL-FEED Systems are installed faster and at lower cost than ever before. All units are preassembled in standard 30 ft. rigid-track sections. That means fewer joints, fewer hangers. Expansion sections are needed only at building joints. No extra rain shields needed for outdoor applications.

You gain maximum safety with LEC-TROL-FEED Systems because current carrying bus bars are almost completely enclosed—minimizing danger from contact with current-carrying bus. Trolley Safety-Slot covers are removable—parts easily accessible. Rugged trolley—can be dropped out every 30 feet.

Additional features include compactness for close vertical stacking, maximum ruggedness, maximum leakage distances, proved aluminum bus bars. Track power capacity 300 amperes, AC or DC; trolley ratings up to 300 amperes.

For complete information, write or ask for LEC-TROL-FEED Bulletin.
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H. K. PORTER COMPANY, INC.

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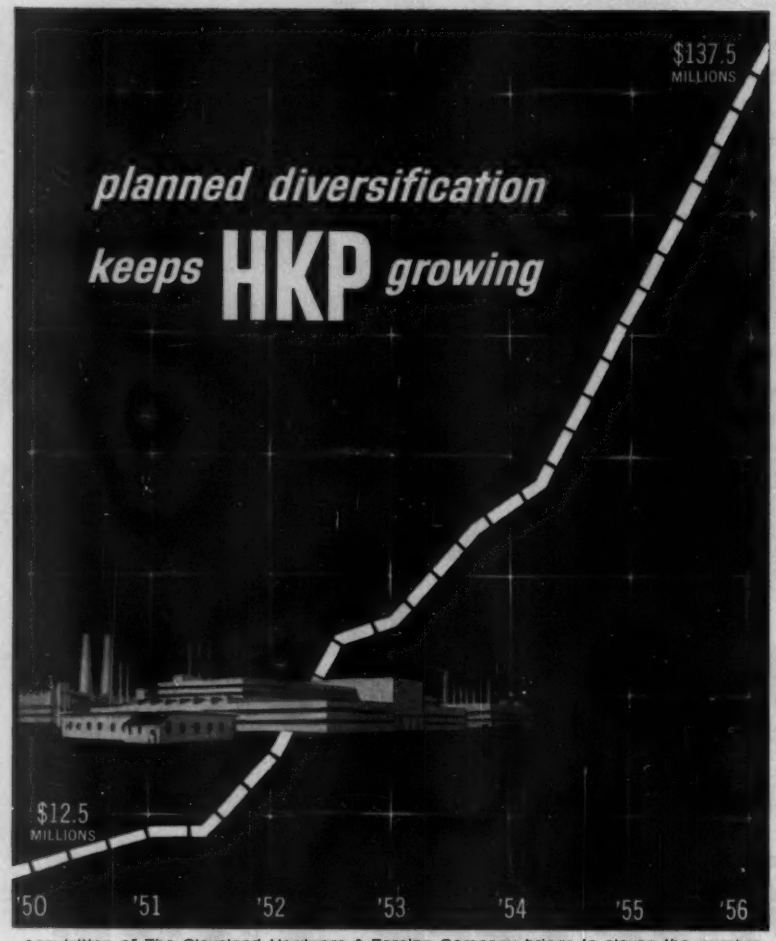
Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.



Acquisition of The Cleveland Hardware & Forging Company brings to eleven the number of versatile Porter divisions. They manufacture products in 40 plants in the United States and Canada, four of which have been acquired so far this year.

Serving industry's needs is a prime responsibility at H. K. Porter Company, Inc. Porter maintains intensive development programs which are translated into new manufacturing developments almost every month.

This awareness of the needs of the market place has resulted in a program of planned diversification...**and a 1150% increase in Porter business volume since 1950.** This volume comes from divisions manufacturing steel and fabricated steel products, copper-alloy metal products, electrical equipment, refractories and industrial rubber, wire and cable.

H. K. PORTER COMPANY, INC.

CLEVELAND • CONNORS STEEL • DELTA-STAR ELECTRIC • HENRY DISSTON • RIVERSIDE-ALLOY METAL
LESCHEN WIRE ROPE • QUAKER RUBBER • REFRACTORIES • VULCAN CRUCIBLE STEEL • W-S FITTINGS
H. K. PORTER COMPANY (CANADA) LTD.

Speeds Night Work

(*Continued from page* 76)

Public Service lamps are equipped with 100 ft of cord and can be hooked to small 1.5-kw generators. Because of the low-wattage consumption, up to three of the lights, plus other small electric-powered tools, can be operated simultaneously off one truck generator.

DISTRIBUTION—Maintenance

Small Shed Permits Work During Rain

An underground crew of the Texas Electric Service Co at Midland, Texas, recently had trouble working directly under a transformer vault opening because of

A SHED was placed over transformer vault opening during heavy rain storm

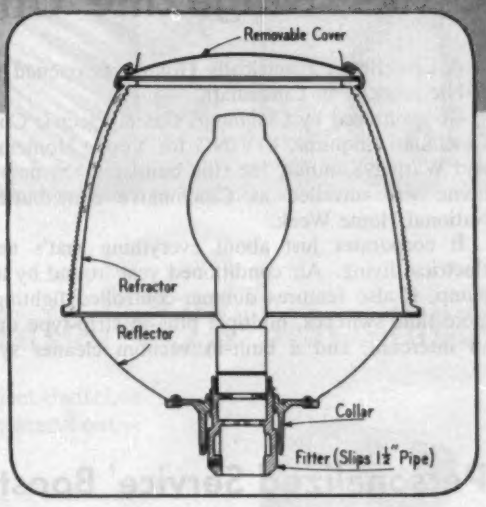
heavy rains. A clearance had been taken for some cable splicing work.

The clearance was called off the first night, but on the second night the work had to be done, despite the continuing rain. TESCO employee offered a small shed which he had built to cover a well he had been digging in his backyard. An A-frame truck was sent for the small structure. The shed was placed over the vault opening.

The crew worked from 10 PM to 6 AM in a dry transformer vault while the rain continued. A door on one side of the structure provided easy access to the vault.

Developed by HOLOPHANE Research and "Know-How"...

◂ The Newest Luminaire *Specially Designed for* OUTDOOR SUBSTATIONS



Behind this new luminaire are the concentrated experience and specialized knowledge accumulated through 35 years of Holophane leadership in outdoor substation lighting . . . Totally new in design and performance — this is the only luminaire in the field to offer all these advantages:

- **Highest Utilization of Light** . . . Upward distribution of more than 60% of total lamp lumens provides effective illumination of overhead structures.
- **Absence of Glare** . . . Light is directed upward, away from operator's vision.
- **Durability** . . . One-piece prismatic refractor is molded ENDURAL* glass. Fixture parts are stainless steel and aluminum. Construction withstands the effects of time, temperature and the elements.
- **Low Maintenance** . . . Sealed gasket assemblies keep unit weather-tight and dirt-free . . . Easy to keep clean . . .
- **Adjustable Light Distribution** . . . Entire unit can be rotated, up or down while lamp is on, to adjust beam of maximum candlepower. Set screw locks unit in adjustment.
- **Easy, Safe Relamping** . . . Unit mounted on bracket or post top; no danger of contact with high voltage.

Write for Engineering Data

For Better Lighting Holophane *BE SPECIFIC . . .*

*®

To be sure of Quality, look for the name HOLOPHANE *impressed in each piece . . .*

HOLOPHANE

COMPANY, INC. • *Lighting Authorities Since 1898*

342 Madison Ave., New York 17, N. Y.

THE HOLOPHANE CO., LTD., 410 KIPLING AVE. SO., TORONTO 14, ONT.

WIRE CUTTING CEREMONY by M. L. Warner, left of Warner-Kantner (builders), and S. M. Hamill, Jr., vice president of Cincinnati G&E officially opened the Live Better Electrically Home at start of National Home Week

CG&E, Magazine Unveil All-Electric Home

A Live Better Electrically Home was opened to the public recently in Cincinnati.

Co-sponsored by Cincinnati Gas & Electric Co, The Cincinnati Enquirer, LIVING for Young Homemakers and Warner-Kantner, Inc (the builders), the new LBE home was unveiled as Cincinnati's contribution to National Home Week.

It corporates just about everything that's new in electrical living. Air conditioned year 'round by a heat pump, it also features dimmer-controlled lighting, remote time switches, multiple plug-in strip-type outlets, an intercom, and a built-in vacuum cleaner system. Kitchen-laundry room is all electric, including such gadgets as an electric can opener and an electric "appliance center", which serves five appliances at once. Full Housepower in it, of course.

The Cincinnati LBE home is one of twelve around the country designed and built in conjunction with Living for Young Homemakers. Cost ceiling, minus land, was set at $18,000 by the magazine.

Cincinnatians have had a chance to win the appliances shown in the home through a contest in the co-sponsoring newspaper, The Enquirer. Winners will get the good news before Christmas.

'Personalized Service' Boosts OPPD Load

MRS. B. E. MARSH, Residential Sales Manager, Omaha Public Power District, Omaha, Neb.

Individualized service is the guiding principle behind two very effective sales tools used by Omaha Public Power District to boost its residential load. Our present residential kwhr consumption is a healthy 3,354 annually, 385 above national average.

The two sales tools are (1) kitchen planning, and (2) lighting and wiring. Here's the way we work with them:

The residential salesman works with the builder, remodeller, lending agency, electrical contractor and the customer. It's his job to see that as many electrical specifications as possible are included in the construction. When a new home is going up, or to be remodelled, he sees the builder and sells him on that the idea that to be really modern the home should have an all-electric kitchen. Once the builder agrees, the salesman has our planning department draw up plans for the kitchen, the lighting and wiring.

Plans Are Complete

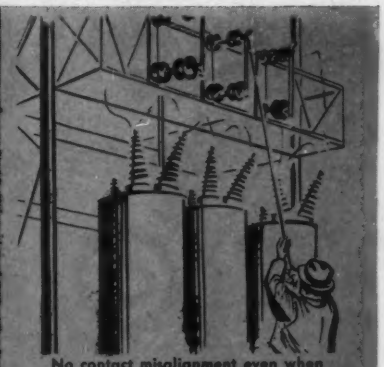
These plans are complete in all details, and may be used to secure bids and as working plans by the builder and the electrical contractor. In addition, we supply a hand painted miniature of how the kitchen will look when completed. This is valuable sales aid to the builder, and of considerable interest to the customer, whether he is building a new home or remodelling an old one.

We follow the same plan for lighting and wiring in other parts of the house. Service is the same to customers whether they are building or remodelling.

We also work directly with appliance dealers. Out salesmen spend a two-week period right at the dealers store. In this way, they get to know the appliance business well, and are able to help the dealer in his sales.

This kind of service to builder, contractor, dealer and customer is greatly appreciated by all. It has paid off well for us. Our load is growing faster than the national average, and this kind of activity will keep it that way.

(*More Selling on page* 84)



No contact misalignment even when switch is operated from the side.

Easy operation even under severe atmospheric conditions.

How to judge the merits of

DELTA-STAR Hook Operated B-2K Disconnects

Consider each advantage offered by B-2K Outdoor Disconnect Switches in light of your specific needs. One or two advantages may stand out—or all may be equally important to you.

You are assured of *long service life* because of rugged, rigid construction, with flared or split tubular blades. This rugged construction also *prevents contact misalignment* even when operator must stand to one side to open or close the switch. *Easy operation at all times* results from efficient blade pryout and lock assembly, with large 3 in. diameter hook ring. The B-2K features *efficient heat dissipation* because ample material is used throughout. Contact pressure-applying springs carry no current, and offer large deflection to *maintain uniform high pressure* contact over extended periods of use.

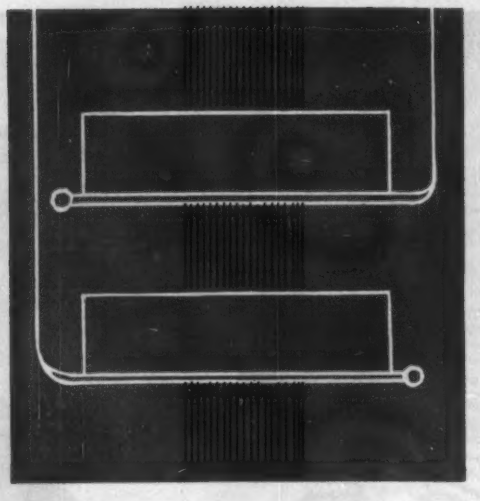
Delta-Star B-2K Disconnects are available in three ampere ratings—1200, 600 and 400—and in voltage ratings from 7.2 kv to 161 kv. They meet your requirements in every respect.

For complete facts, write for "B-2K Disconnect Switch Catalog." *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois.*

H. K. PORTER COMPANY, INC.

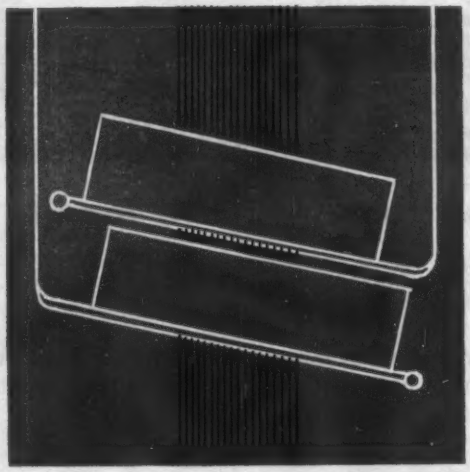
DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

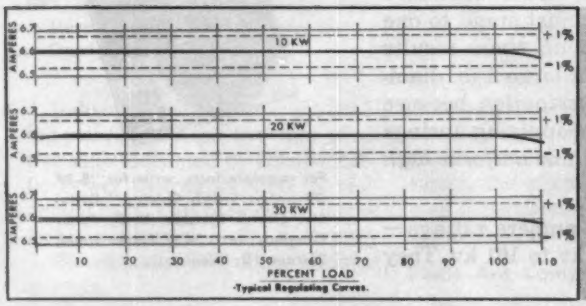


The exclusive Moloney double-moving-coil design under approximately half-load condition. (Note parallel position of coils.)

ONLY MOLONEY OFFERS THE DOUBLE-MOVING-COIL CONSTRUCTION



Under full load conditions the coils move to this position. Notice that the coils are parallel to each other under this or any loading condition.



Typical Regulating Curves.

Typical regulation curves. Excellence of regulation is due to the use of a well-balanced electrical design, together with Moloney's *double-moving-coil construction.*

This exclusive external adjusting mechanism permits current adjustment without removing hand-hole or transformer cover . . . seven positive-stop positions.

MOLONEY ELECTRIC COMPANY

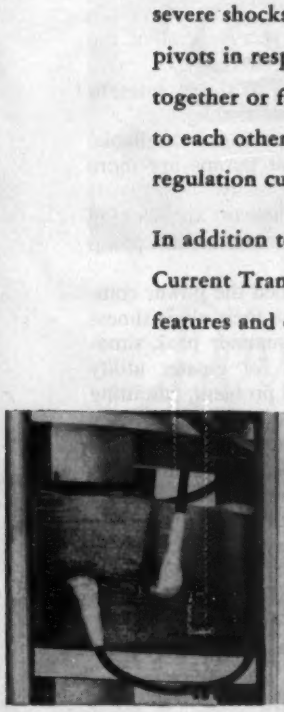
Manufacturers of Transformers for Utilities, Industry and Electronic Applications

EXCLUSIVE ADVANTAGES OF IN *Constant Current Transformers...*

This exclusive feature permits quicker response with less severe shocks due to short circuit conditions. Each coil pivots in response to circuit changes to move closer together or farther apart and the coils are *always* parallel to each other. The end result is a superior regulation curve.

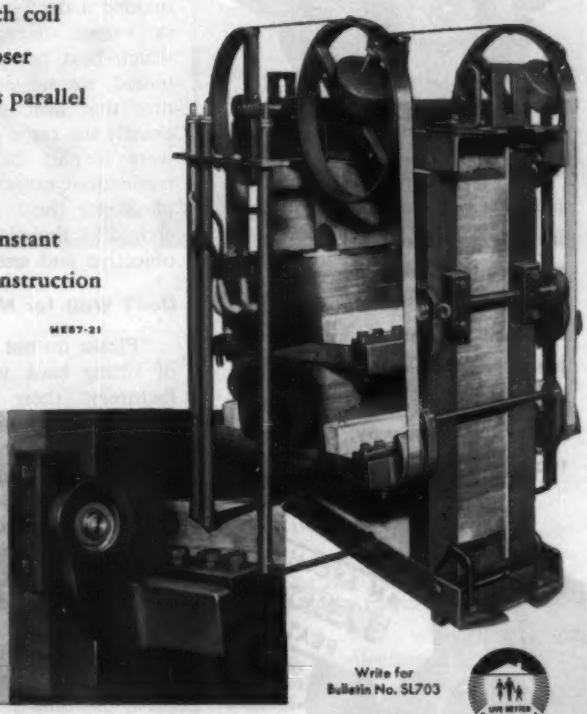
In addition to this exclusive feature Moloney Constant Current Transformers also offer the following construction features and operating advantages.

ME87-21



Flexible coil leads facilitate faster movement of the coils and minimizes the possibility of service interruptions due to lead breakage.

All moving parts, including coil supports, are fitted with precision ball bearings to insure free movement.



Write for Bulletin No. SL703

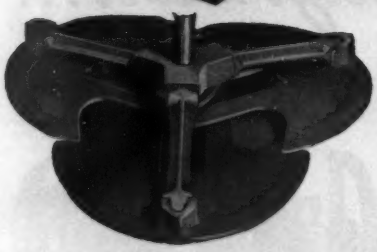
FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

Sales Offices in All Principal Cities

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

GE's Brundage Cautions SEE Utilities to Get Rolling With Heat Pumps Now

Now is the time for utilities to aggressively go after the heat pump load. So went the theme ("A Time for Decision") of a staccato, 45-min., reason-punctuated speech before the Southeastern Electric Exchange Sales Meeting by H. M. Brundage, general manager of General Electric's Weatherton Division.

BRUNDAGE

Describes the Situation

After pegging the present heat pump situation (consumer appetite for better living, inadequate promotion, high but decreasing first costs), Brundage dropped a verbal bomb that brought more then one utility head up with surprise. Said he: "In making a decision as to the degree or extent of aggressiveness with which heat pumps should be promoted, we suggest that you recognize that heat pumps are having exactly the same growing pains that were a part of electric cooking (residential ranges). In this respect plans for heat pump promotion should be thought of with the same objective and energetic approach."

Don't Wait for Manufacturers

"Please do not make the mistake of sitting back waiting for manufacturers, their distributors and dealers to put on grandiose promotional programs backed up by national advertising and all the other gimmicks of present day merchandising. The manufacturers can not do this job for the very simple reason that there is not that kind of profit available, and profit is their only excuse for existence. Heat pump manufacturing is not profitable from the first—but the electricity the utility sells *IS* profitable from the moment the heat pump is turned on. Therefore, if the heat pump is to be evaluated in terms of its kilowatt hour contribution to utility load, the promotion *must* come from utilities or else the product will not be promoted."

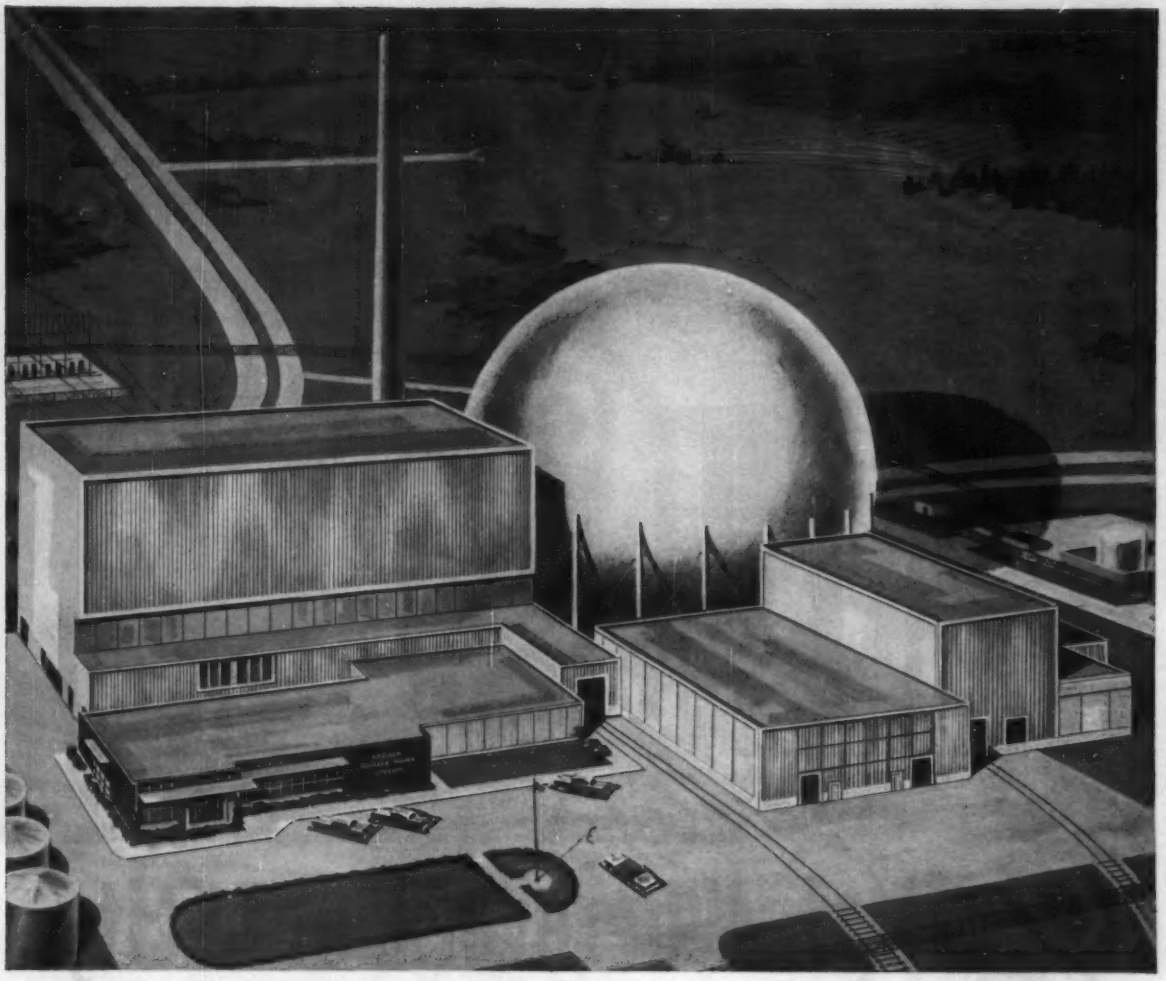
But why must utilities promote the heat pump *now?* Brundage cites five reasons:

- We're two years ahead of the gas industry in technology.
- Gas may go to dump rates to boost gas air conditioning.
- Retail distribution is available.
- Today's heat pumps are more reliable and less costly.
- Buying influences are looking to utilities to promote the heat pump market.

Brundage chided the power company men about their sluggishness in gauging the summer peak situation. He called for greater utility study of the load problem, admitting that his own were "geographically spotty and not sufficient in depth." "We make a specific recommendation to the Southeastern Electric Exchange . . . that they appoint a committee to lay out the modus operandi whereby any utility company within their own service area will know what facts are required, how to get them and how to interpret them."

No small part of Brundage's talk was taken up with all-or-nothing activities of the gas industry to develop more marketable gas air conditioners and heat pumps (EW, July 1, 1957, p76). Example: AGA doubled its 1957 research budget from $375,000 to $750,000.

(*More Selling on page* 88)



Developing the Peaceful Atom

The year 1957 brought two highly significant nuclear power developments.

One was the start of major construction on Commonwealth Edison's Dresden Nuclear Power Station near Chicago. At 180,000 kilowatts, this privately financed plant is the largest all-nuclear power station yet scheduled.

The other was the completion of General Electric's Vallecitos Atomic Laboratory in California which will aid electric utilities to meet growing power demands by helping to speed competitive nuclear power.

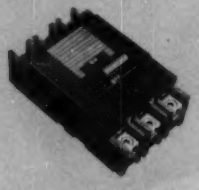
Both are Bechtel engineering and construction responsibilities and Bechtel is a member of Nuclear Power Group Inc., which developed technical studies for the Dresden project, on which General Electric Company is prime contractor.

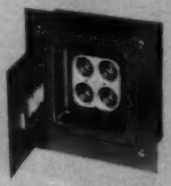
BECHTEL CORPORATION *Engineers and Builders for Industry*

San Francisco • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED Toronto • Vancouver

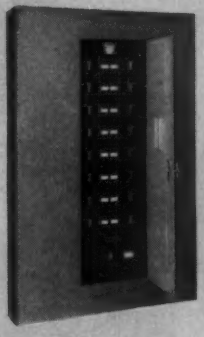
• Safety Switches and Industrial Circuit Breakers



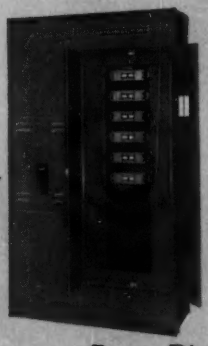


• Fusible and Circuit Breaker Load Centers

• Voltage Testers

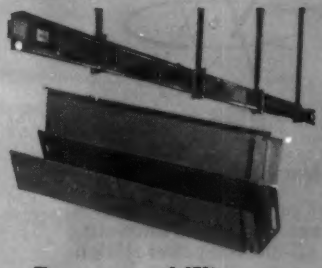


• Fusible and Circuit Breaker Lighting and Power Panelboards



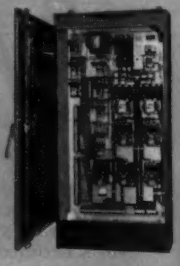
• Power Distribution Switchboards and Switchgear

Wherever Electricity



• Busways and Wireways

EC&M High Voltage and Synchronous Starters



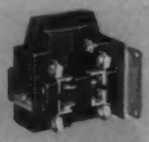
• Special Purpose Control

• Control Centers

SQUARE D COMPANY

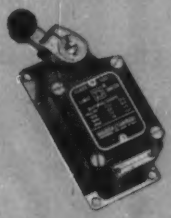
• A.C. Manual and Magnetic Starters

• Drum Switches



• Control Relays

• Timing Relays

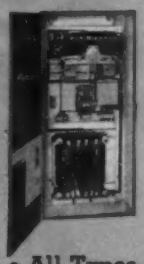


• Limit Switches

• Pushbuttons

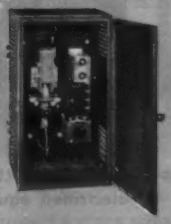
• Combination Starters

• Manual Compensators

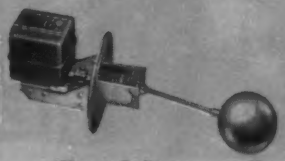


• All Types of Reduced Voltage Starters

• D.C. Starters



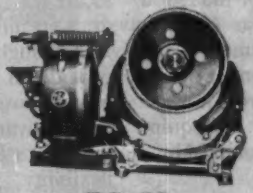
• Electronic and Electro-Magnetic Welder Control



• Float & Pressure Controls for Pumps & Compressors

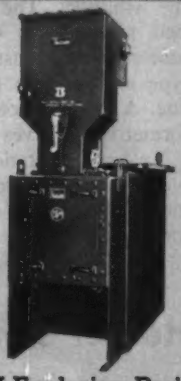
is Distributed and Controlled

EC&M Lifting Magnets

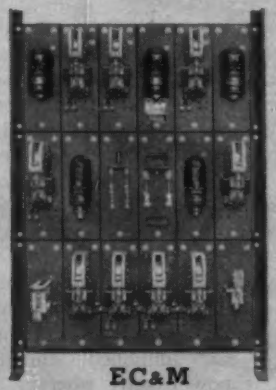


EC&M Magnetic Brakes

FIELD ENGINEERING SERVICE
available through Square D branch offices in all principal United States cities
... and in Canada, Mexico and England

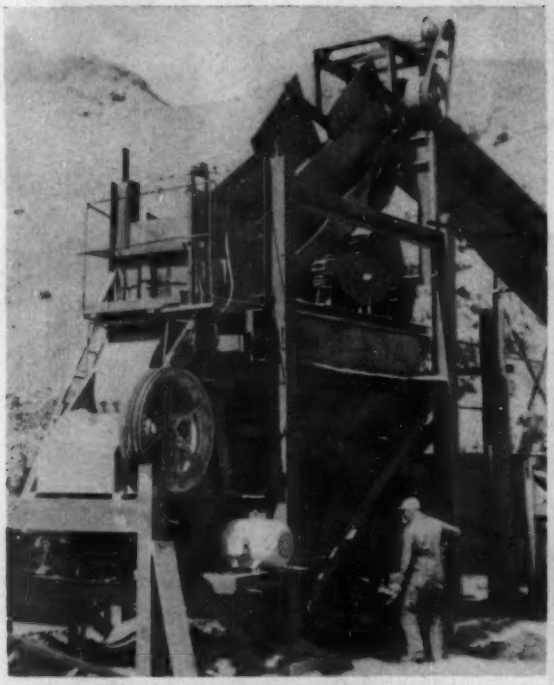


EC&M Explosion-Resisting Control for Petroleum Industry

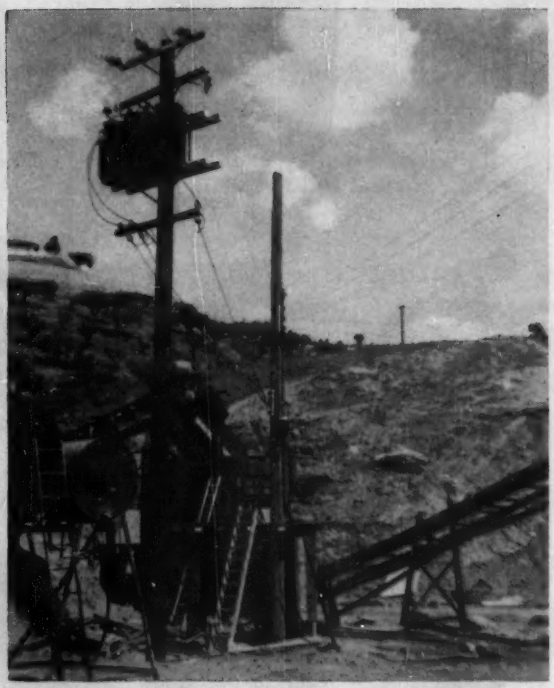


EC&M Crane and Mill Control

DESIGN LEADERSHIP FOR MORE THAN 50 YEARS



GRIZZLY, CRUSHER AND VIBRATOR use total of 42.5 hp, operate from 480-v line. Main conveyor motor is 45 hp



150-KVA POLE-MOUNTED TRANSFORMER bank serves new electrified equipment. Quarry motor load totals 160 hp

Electric Power Boosts Quarry Production

F. A. BEWLEY, Commercial Sales Representative, Pacific Gas & Electric Co, San Jose, Cal.

A switch to electric power and a modernization program have boosted production by 90% at Roggasch Brothers rock quarry in San Jose, Cal. With new equipment installed and three natural gas-operated engines replaced by electric motors totalling 160 hp, daily output has climbed from 2,100 to more than 4,000 tons.

Downtime for repairs and maintenance has been cut sharply. Eliminating the cranky, difficult to start engines has simplified start-up. Power is now exactly where it is wanted and the operation is more flexible. The modernization reduced labor needs, enabling the owners to transfer two men to other operations. Revenues are up, too.

The new motors are used to operate a grizzly, crusher, and vibrator on the main conveyor line. A 7.5-hp motor drives the grizzly, a 30-hp unit the crusher, and a 5-hp motor the vibrator. The main conveyor belt motor is a 45-hp unit. All motors are the dust-proof induction type and operate from a 480-volt line. A 150-kva pole-mounted transformer bank serves the units.

Two master stations provide complete remote control for the equipment. Emergency control pushbuttons are easily accessible.

While the conversion was being made, the Roggasches built a new quick-dump hopper and moved their conveyors to a more convenient location. The new grizzly and vibrator were installed at the same time.

Although the gas engines were considered to be economical, the owners were convinced that the many advantages of electricity were the key to increased production and flexibility.

Heater Simplifies Gasket Handling

EDWARD PAUL, Power Sales Engineer, Pennsylvania Power & Light Co, Scranton, Pa.

A 5-kw immersion heater solved a plastic heating problem at the Poloron Products, Inc, in Scranton, Pa. Placed in a covered and insulated tank, it provides hot water to heat up a polyethylene gasket used in record player cabinets. Heated to approximately 210 F, the polyethylene becomes more pliable, is much easier to install. A thermostat holds the oven temperature at the desired level. Poloron had previously tried baking the strips in an oven but found that this method produced discoloration or spotting.

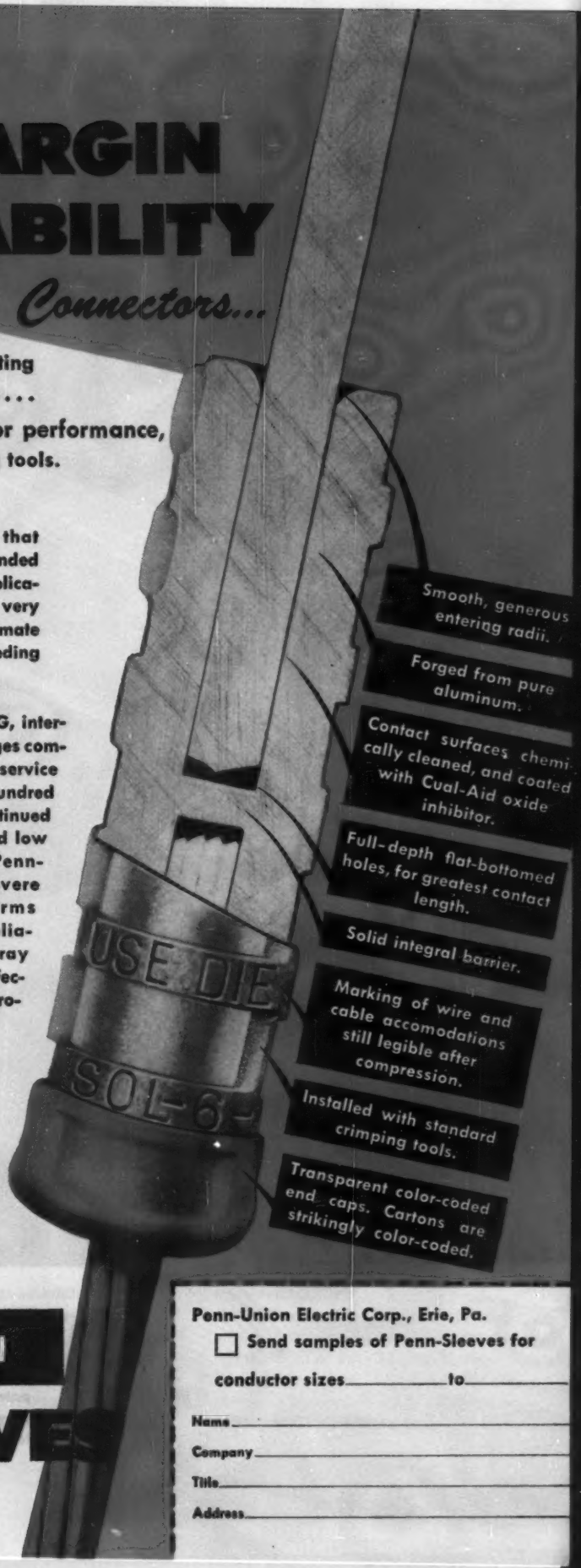
Get this
EXTRA MARGIN
of DEPENDABILITY
in your Compression Connectors...

You can specify sleeves that in most exacting tests★ have far exceeded normal demands . . .

Sleeves designed to assure superior performance, for use with existing standard crimping tools.

★TENSION TESTS show that Penn-Sleeves, although intended for loop or non-tension applications, actually have a grip very close to the conductor's ultimate tensile strength — far exceeding service requirements.

★HEAT CYCLING, intermittent current surges compressing years of service life into several hundred hours—proves continued low resistance and low temperature of Penn-Sleeves under severe overload—confirms their superior reliability. ★Salt Spray tests prove their effectiveness under corrosive conditions.


USE DIE
SOL-6-
Smooth, generous entering radii.
Forged from pure aluminum.
Contact surfaces chemically cleaned, and coated with Cual-Aid oxide inhibitor.
Full-depth flat-bottomed holes, for greatest contact length.
Solid integral barrier.
Marking of wire and cable accomodations still legible after compression.
Installed with standard crimping tools.
Transparent color-coded end caps. Cartons are strikingly color-coded.

For highest dependability in all your ½-inch and ⅝-inch compression connectors, CU-AL and AL-AL—make your own tests of Penn-Sleeves. *Mail the coupon for Samples of the Sizes you intend to use-- or are now using.*

Penn-Union Electric Corporation, Erie, Pa.

PENN-UNION

PENN-SLEEVES

Penn-Union Electric Corp., Erie, Pa.

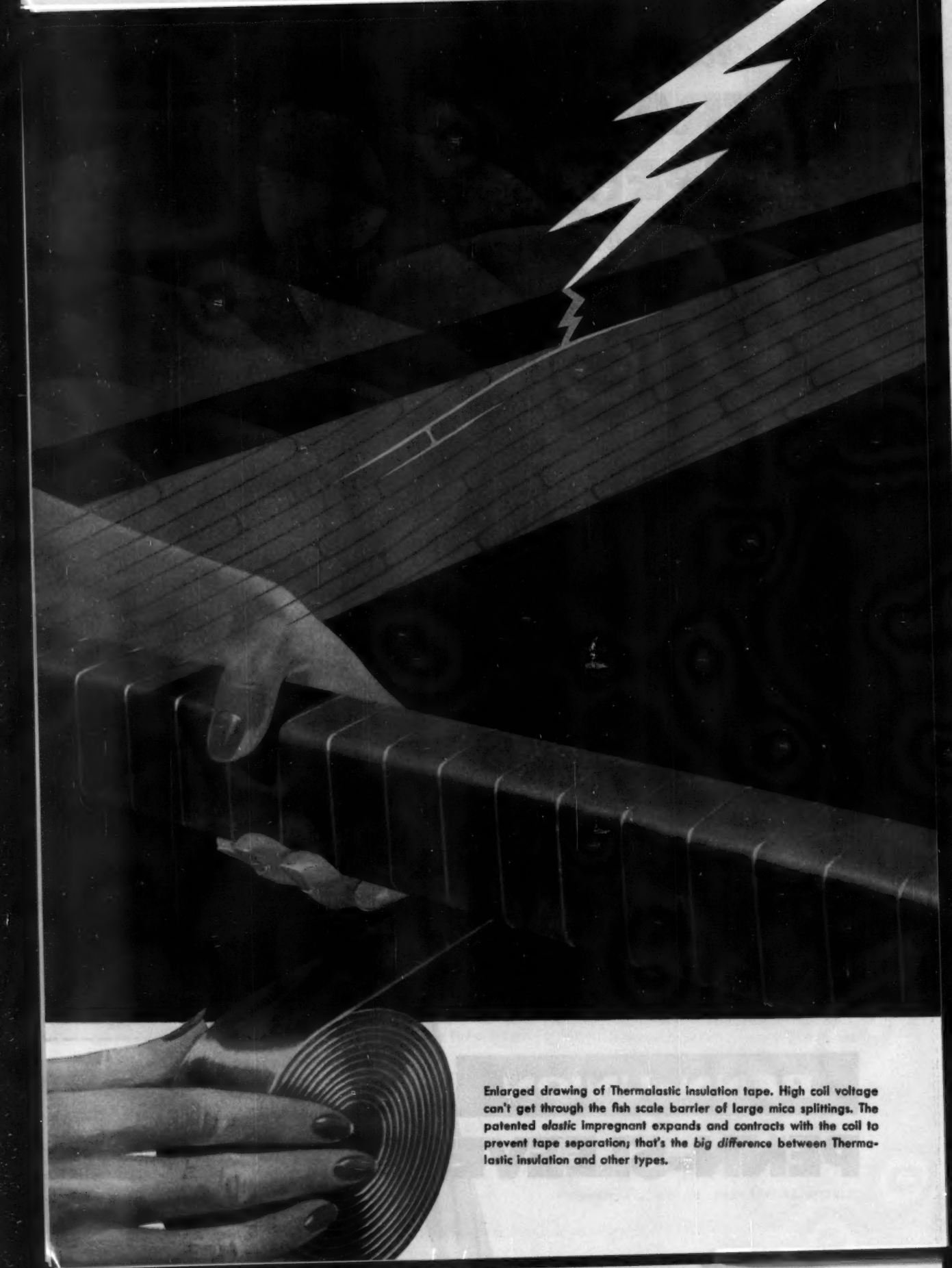
☐ **Send samples of Penn-Sleeves for conductor sizes_____ to_____**

Name_____

Company_____

Title_____

Address_____



Enlarged drawing of Thermalastic insulation tape. High coil voltage can't get through the fish scale barrier of large mica splittings. The patented *elastic* impregnant expands and contracts with the coil to prevent tape separation; that's the *big difference* between Thermalastic insulation and other types.

Here's why Thermalastic insulation ends major cause of generator and motor failure

LARGE mica splittings have long been recognized as the most reliable coil insulation material, but for years it seemed impossible to find the RIGHT impregnant for the insulation tape.

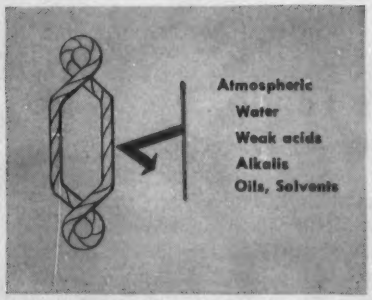
Some were too brittle and others too plastic at high coil temperatures; none could withstand repeated expansion and contraction of the coil . . . and sooner or later, tape separation caused failures.

Then the great discovery — In 1949, Westinghouse research scientists made *Thermalastic*® insulation a reality by discovering the "miracle resins" which cure to a *tough* resilient solid. Large mica splittings, overlapped like fish scales, are locked in this elastic bond which "breathes" . . . expands and contracts with the coil. It doesn't harden or soften with repeated heating by the coil. It doesn't deteriorate with age.

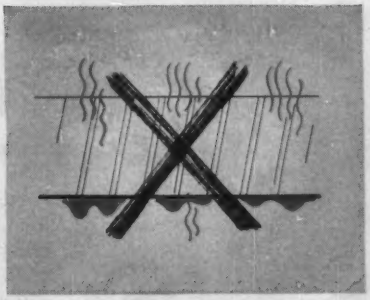
New color movie and bulletin show how and why Thermalastic insulation has extended the life of more than 40 million kva of generators and large motors. Contact your Westinghouse representative or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-15004

YOU CAN BE SURE...IF IT'S

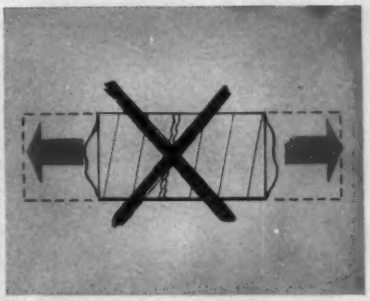
Westinghouse



Withstands attacks
which weaken and finally destroy other insulations. The Thermalastic insulation bond is void-free, has great density, and it's chemically inert. The physical strength of the resilient insulation wall is far greater than that of ordinary insulations.

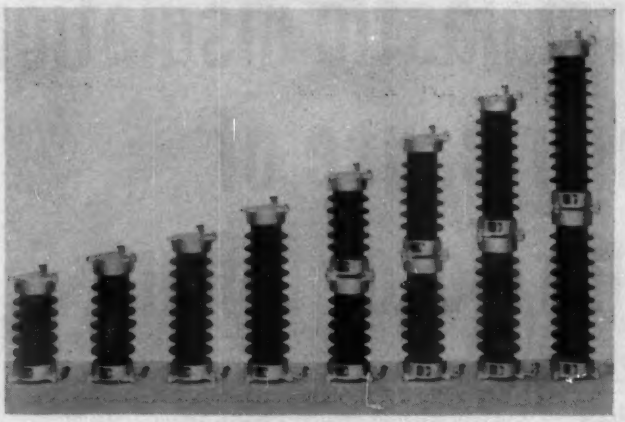


Doesn't soften or embrittle
The patented resins in Thermalastic insulation are thermosetting . . . heat changes them from a liquid to a permanently elastic solid which doesn't soften or embrittle after repeated heating. And it doesn't deteriorate while in storage or in use.



Not stressed
The insulated coil is heated to operating temperature, and *while it's expanded*, the resins cure to an ELASTIC solid. That's why Thermalastic insulation is relaxed when the coil expands, compressed when it contracts. It flexes when the coil is overloaded.

NEW EQUIPMENT



Lightning Arresters . . .

. . . for direct mounting on transformers and other substation equipment are compact and simply designed. The new type F is an intermediate class arrester in ratings of 20, 25, 30, 37, 40, 50, 60, and 73 kv.

Valve discs and spark gaps alternate throughout the stack. Ceramic rings with non-linear resistance characteristics assure uniform power-frequency voltage between gap electrodes. Sparkover is same wet or dry. Power follow current stays low, and is effectively interrupted by simple gap structure.

Line Material Industries, Milwaukee 1, Wis.

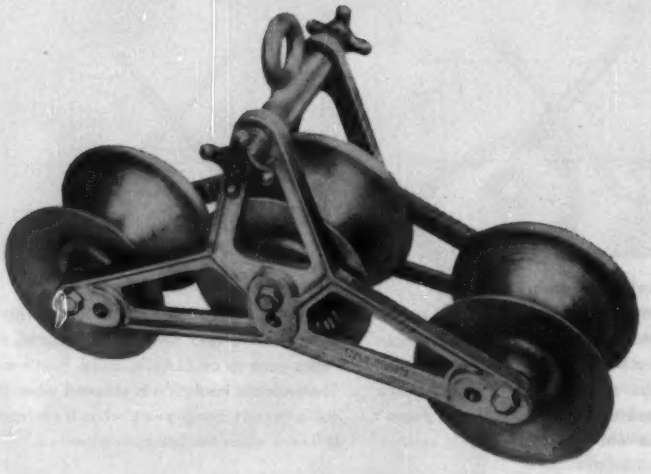
Street Lighting Control . . .

. . . uses cadmium selenide photocell in place of tubes, transistors, or magnetic load relay. The electro-mechanical control switches street lighting circuits automatically, without "drift" or heating. Photocell senses any change in surrounding light conditions, but system is protected against transient light such as automobile headlights by an integral time delay. The system also incorporates a synchronous motor and a high-capacity snap-action switch.

The control can be set within a range from 0.5 to 8 ft-c. Both turn-on and turn-off points can be adjusted. Load rating is 1,200 w at 120 or 240 v.

Control is totally enclosed in plug-in type casing which is interchangeable with existing mountings. Pole or cross-arm mounting is also available.

Tuttle & Bailey, Allied Thermal Corp, New Britain, Conn.



Cable Guide . . .

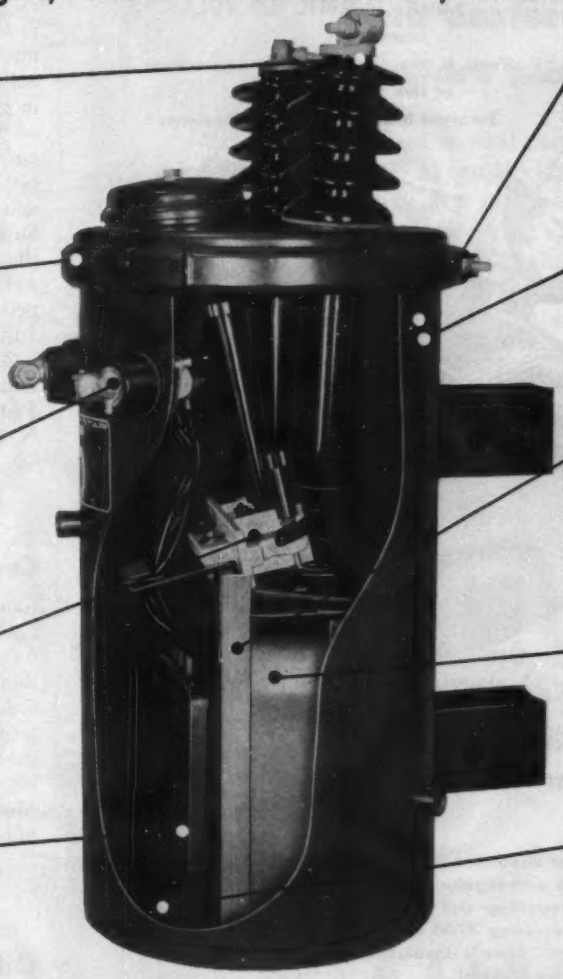
. . . has three pulleys to simplify installation of cables in a cable trough or ladder system. Three aluminum sheaves are mounted in aluminum frame that can be secured to a structural support, making it easy to pull cables around horizontal or vertical bends.

Pulleys are adjustable to different radii, permitting one device to be used for almost any turn desired. Cables can thus be laid over frame rather than having to be pulled through.

T. J. Cope Div of Rome Cable Corp, Collegeville, Pa.

(More New Equipment on page 94)

HERE'S HOW DELTA-STAR DISTRIBUTION TRANSFORMERS* offer lighter weight, easier maintenance, and improved core



BUSHINGS
Double-keyed—connector to porcelain—porcelain to tank. Assures positive lock against rotation.

COVER
Assures positive seal—and natural shedding of water. One-piece non-corrosive clamping band with re-usable nitrile rubber gasket.

TERMINALS
Tin-plated bronze alloy. Spring loaded to accommodate aluminum or copper conductors.

TAP CHANGER
Positively positioned. Liberal voltage-creepage distance. Handle grip above oil. Shorting bar under spring tension.

COIL
Wound with liberal insulation. Heavy Formvar wire. Ducts provide maximum, uniform cooling.

TANK
Design minimizes number of external parts. Pressure-tested for perfect sealing. Reinforced bottom edge.

FINISH
Provides maximum corrosion-protection. Special metal preparation prior to alkyd painting. All primer and finish coats baked.

CORE-COIL ASSEMBLY
Will not shift under severest handling conditions. Securely anchored to tank wall. Positively braced against short circuits.

PORTER CORE
Grain-oriented, cold-rolled silicon steel. Assures low losses, smaller tank, minimum weight.

INHIBITED OIL
Gives extended life with better insulating characteristics. Specially processed immediately before filling.

With single phase ratings from 3kva to 167kva, in standard voltages through 15,000 volts, this complete line of Delta-Star Transformers embodies the latest developments in transformer design . . . a pole type built to fully meet NEMA standards.

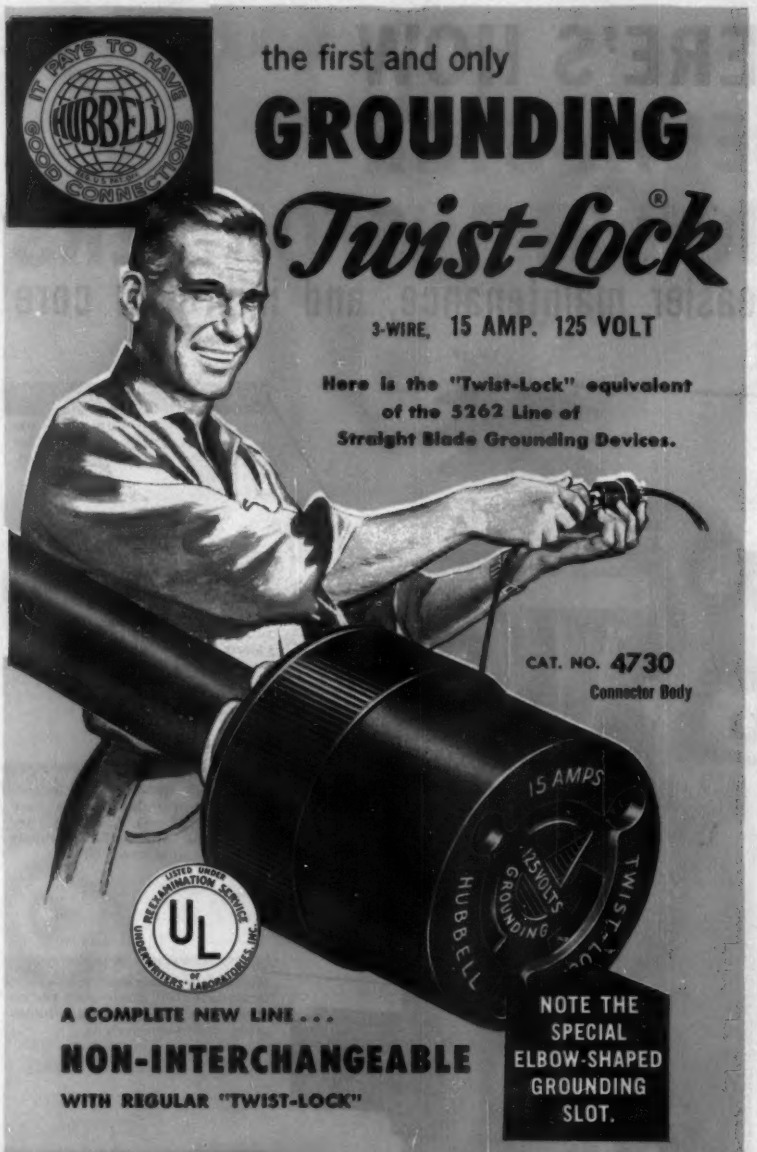
Send for 16-page illustrated catalog. **Write to H. K. Porter Company, Inc., Delta-Star Electric Division, 17th and Cambria Streets, Philadelphia 32, Pa.**

***PATENTS APPLIED FOR**

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.



These new 4700 Series Grounded "Twist-Lock" units are polarized to prevent interchange with regular 125-volt "Twist-Lock" devices. An elbow-shaped grounding slot prevents insertion of regular "Twist-Lock" caps, accepting 4700 Series caps only. With 4700 Series "Twist-Lock" units there is absolutely no danger of plugging into a 3-phase circuit by accident.

Write today, for complete information.

HARVEY HUBBELL, INC.

HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS

DEPT. E-2 BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS

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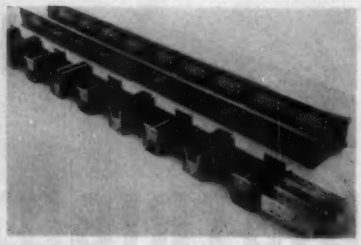
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street



Bus Ducts . . .

. . . of feeder and plug-in type are redesigned to permit assembly of tees and elbows during installation. Self-supporting bus bars are secured in place on 11-in. centers by means of bolted phenolic blocks. Heavy current take-off devices can be bolted on bus without disturbing splice between installed sections. Supplied with totally enclosed, ventilated, or weatherproof housings, welded on three sides, the low-impedance ducts are rated 600, 800, 1,000, 1,350, 1,600, 2,000, 2,500, 3,000, and 4,000 amp. Covers are bolted for accessibility to bus.
Federal Pacific Electric Co, 888 N. Keyser Ave, Scranton, Pa.

Corrugated Sheath . . .

. . . is sealed conduit for "built-in" cable. Bending radius is limited only by that of the cable it contains. Lightweight and strong, C-L-X (continuous, lightweight, exterior) corrugated metal sheathed cable can be installed in trays or by clamps, aerially or buried.
Simplex Wire & Cable Co, 79 Sidney St, Cambridge 39, Mass.

Oil Switches . . .

. . . can be operated manually. Type VR now comes in two additional models. New VM models have manual-remote handle, and VH models are equipped for hookstick operation. The 3-phase switches are rated 15 kv, 400 amp, and 110 kv BIL.

Switching ratings at 7.2 kv are 400 amp for lagging pf above 75%, 200 amp for lagging pf of 50 to 75%, and 100 amp for lagging pf

(*Continued on page* 96)

CF&I GALVANIZED STEEL STRAND

for guy, messenger and overhead ground wire . . . quickly available from both eastern and western plants

No matter what part of America you're in, CF&I can quickly supply your needs for top-quality, guy, messenger and overhead ground wire. That's because three- and seven-wire CF&I Galvanized Steel Strand is made at both Buffalo, N. Y., and Pueblo, Colo.—a combination of plant sites that's ideal for speedy, nationwide distribution.

What's more, you can be sure of the quality of CF&I Galvanized Steel Strand because every phase of its production is supervised by the manufacturers of world-renowned Wickwire Wire Rope and Wire Rope Slings.

Next time you need strand—whether it's to your own specifications or to ASTM Specifications A-122 or A-363—be sure you explore the many advantages offered by CF&I Galvanized Steel Strand. Better still, contact your nearby CF&I representative today.

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise
Boston • Buffalo • Butte • Chicago • Denver • Detroit
El Paso • Ft. Worth • Houston • Kansas City • Lincoln
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CF&I OFFICES IN CANADA: Montreal • Toronto

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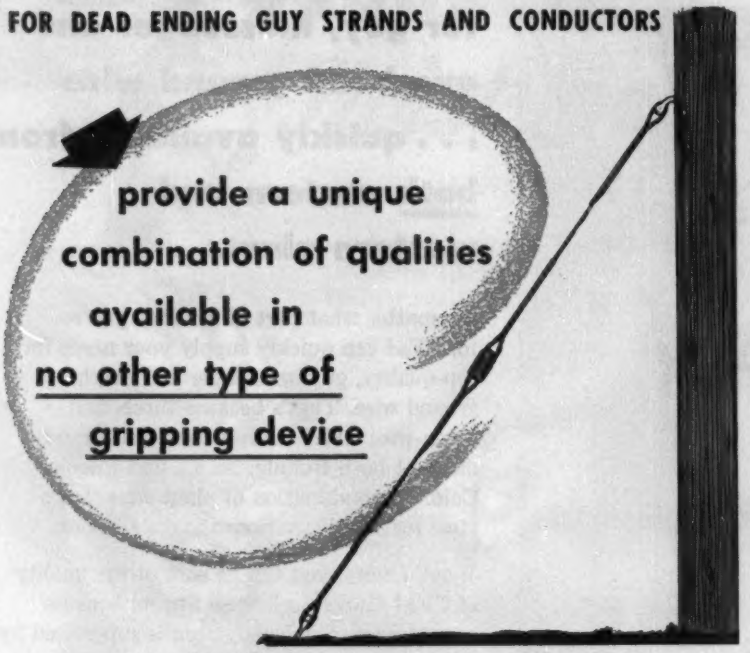
FANNER FANNGRIPS

FOR DEAD ENDING GUY STRANDS AND CONDUCTORS

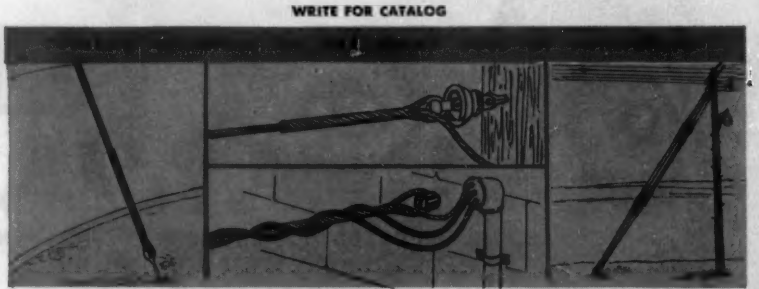


FANNGRIPS are made of highest grade spring-type wire by Fanner's exclusive roll-forming process. They provide a permanent and positive grip, and, because the frictional force is greater than the strand strength, FANNGRIPS cannot slip!

- Provide maximum load strengths — eliminate variables in application.
- Apply in a minimum of time — eliminate laborious field fabrication.
- Permanently tight, self-clamping — no movement or relaxation due to load reversal.
- Corrosion resisting.
- May be removed and reapplied when necessary.
- Do not damage surface of strands.
- Neat application without bulk — no dangerous or wasteful ends.
- Available in electro galvanized steel, copperweld or aluminum alloy.

No other dead-ending method matches FANNGRIPS economy!

WRITE FOR CATALOG



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Fine Fanner Superformed

THE FANNER MANUFACTURING COMPANY

Electrical Products Division

BROOKSIDE PARK • *Established 1894* • CLEVELAND 9, OHIO

Telephone: Shadyside 1-6000

AGENTS and DISTRIBUTORS IN PRINCIPAL CITIES

ARMOR RODS • LINEGUARDS • TAP ARMOR
PATCH RODS • FANNGRIPS • PLASTIC FANNGUARDS
PLASTIC INSULATING TUBINGS AND MOLDINGS

Oil Switches

(*Continued from page* 94)

of 10 to 50%. At 14.4 kv, ratings are 200, 100, and 50 amp. Units switch up to 300 amp capacitive current. Momentary and latching: 20,000 amp asymmetrical. Four-sec rating is 6,000 amp symmetrical.
Line Material Industries, Milwaukee 1, Wis.

Oscillograph . . .

. . . records directly at writing speeds up to 20,000 in. per sec. It has 36 channels and 15 speeds from 0.1 to 160 in. per sec. Frequency response of 3 kc is achieved without peaked amplifiers. Weight of Model-1012 "Visicorder" is 160 lb. Deliveries are expected by mid-1958.
Heiland Div, Minneapolis-Honeywell Regulator Co, Denver, Colo.

Vibration Monitor . . .

. . . protects rotating equipment in hazardous locations. All vacuum tubes are eliminated from the system, which is available for ac or dc circuits. Both malfunction detector and control units are mounted in explosion-proof casings. Control unit provides time delay after start, preventing alarm or shutdown from single shocks or transient disturbances. Resetting can be manual, electrical, or automatic.
Robertshaw-Fulton Controls Co, 2920 N. Fourth St, Philadelphia 33, Pa.

(*More New Equipment on page* 100)

FROM TOP TO BOTTOM, INSIDE AND OUT,

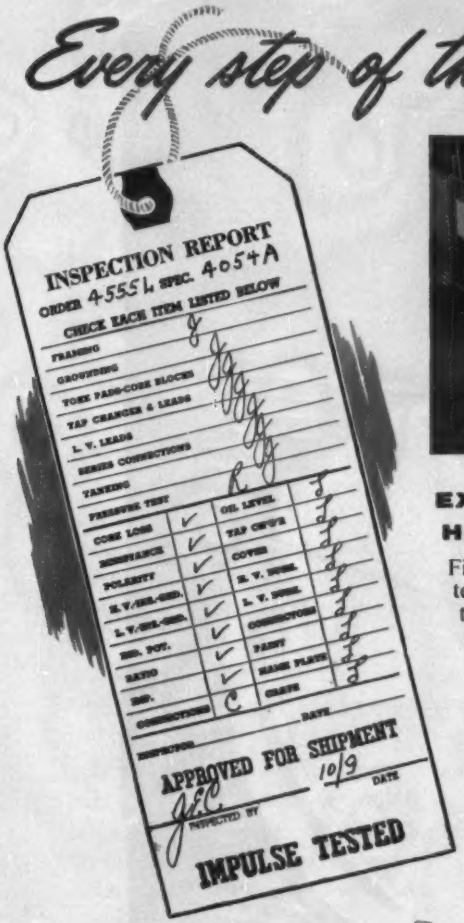
CENTRAL

TRANSFORMERS

are PLUS Tested

Every step of the way!

CTC



We Design and Manufacture Quality Transformers —Nothing Else!

EXTRA Tests Assure Consistent and Uniform High Quality In Every Central Transformer

Final testing of the finished product is a basic step in Central's production technique. Standard ASA tests represent only part of Central's final testing procedure. Below are some of the PLUS tests—conducted at no extra cost to the customer—which insure uniformly high quality in all Central Transformers:

- Central Distribution Transformers, 167 KVA 15 KV and below, are Production Line Impulse Tested.
- Central Transformers above 167 KVA or 15 KV and every fifth unit 167 KVA 15 KV and below are tested for Insulation Power Factor and Insulation Resistance.
- Just prior to crating, the oil in EVERY Central Transformer is sampled for Dielectric tests.
- Every drop of oil in Central Transformers is monitored by a Doble Water-in-Oil Meter.
- Central's 1600-KV Impulse Generator and other test facilities assure positive selection of only the finest, top-grade materials.

Remember, the "extras" are standard in all Central Transformers.

Just one more reason why Central Transformers are PREFERRED throughout the nation

Central
TRANSFORMER CORPORATION

PINE BLUFF, ARKANSAS
Telephone JEfferson 4-5332

NEMA

Sales Offices in Principal Cities

Of course it's the finest

Type 45 Circular Chart Recorder

. you specified it

We married your ideas to Westinghouse quality

It's new. It's versatile—designed for switchboard mounting or complete portability. It has a unique and exclusive sealed inking system. We can't cover all the special features in the space here.

But the features are the ones *you* wanted—specified when we asked questions of hundreds of engineers and operating men in a predesign survey.

Type 45 is rated at 2% accuracy—but can readily be supplied and guaranteed at 1%. It is weatherproof—neoprene-gasket-sealed—fabricated from corrosion-resistant aluminum alloy. Sapphire bearings are spring mounted to absorb shock. Terminals are in an enclosed housing.

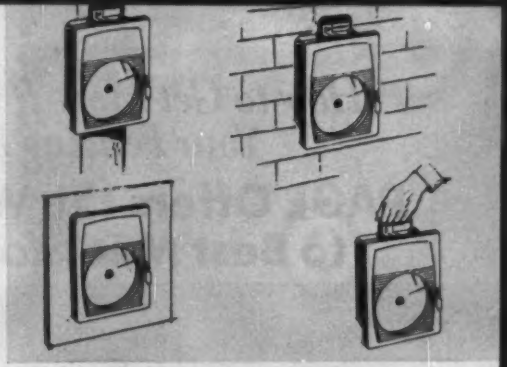
And you get the plus benefit of circular chart recording—more information on less paper, convenient to store and file—less operating cost.

It surely is *your* instrument. You can get all the details—and see a sample—by calling your Westinghouse sales representative. Or you can write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., requesting booklet B-7212 and catalog section 43-450.

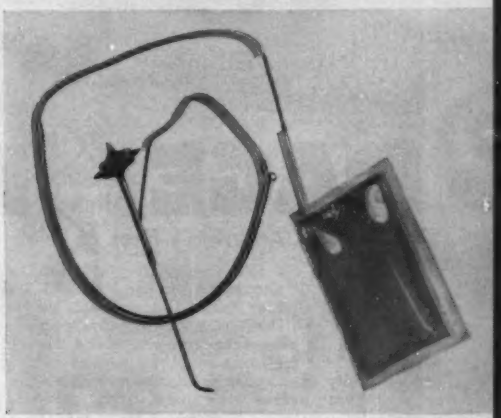
J-40496

YOU CAN BE SURE...IF IT'S

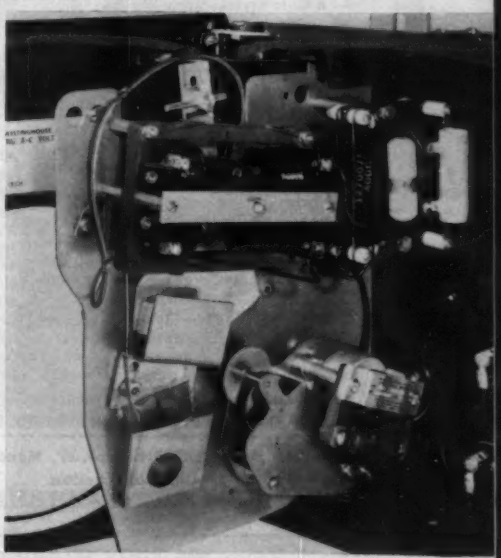
Westinghouse



CONVENIENT—Suitable for flush or projection mounting on a switchboard. Styling coordinated to match other Westinghouse instruments. Portable, too. Adjustable brackets for pole or wall mounting. Clocks either synchronous or 8-day hand-wound. Interchangeable gears for one- or seven-day chart speed. Three-day gears available.



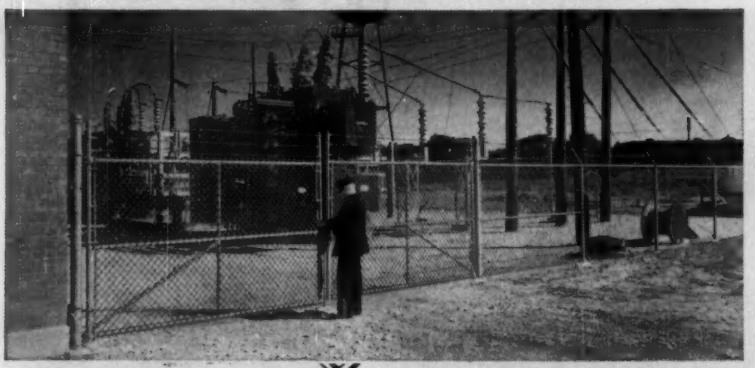
SEALED INKING SYSTEM—Unique for direct-acting electrical instruments. No inkwell. The ink is in a plastic sac, with a plastic tube to the pen. Ink supply lasts a year. No coagulation or evaporation. Pen is Inconel, stainless and corrosion-proof. Tip is platinum-iridium to assure sharp, continuous record.



EASILY SERVICED—You can change charts with your gloves on. Zero adjustment is accessible from open front cover. Built-in pen lifter saves fumbling, misalignment—automatically resets when cover is closed. Entire movement mounted on hinged panel. Just disconnect terminals and lift out. Recorder does not have to be level to operate perfectly.

How to Get More for Your Fencing Dollars...

PAGE Offers the Widest Choice to Best Meet Your Needs!



PAGE chain link FENCE

America's First Wire Fence—since 1883

Your property protection should be and can be MORE than just a fence. It can be the RIGHT fence for you because you can make decisions from the widest variety of choices available anywhere. Every part of your fence will be quality controlled by PAGE from metal billet to the complete, erected fence.

You can choose from —

- 8 Fence Styles
- 8 Fence Heights
- 4 Fabric Metals
- 2 Types Metal Posts
- 6 Gate Styles, Many Widths
- Single or Double Barbed Wire Arms
- Top Rail or Top Wire

Important Advantages for You

PAGE pioneered in providing a wider choice of long-lasting fence fabric metals. Each of them possesses characteristics which meet individual preferences or make it more suitable to meet certain climatic or service conditions.

GALVANIZED STEEL • PAGE fabric of this class is woven of time-proved basic open-hearth steel wire, hot-dip galvanized after weaving to assure long, reliable service.

ALUMINIZED STEEL • By a PAGE patented process a coating of commercially pure aluminum is bonded to steel wire to provide longer corrosion resistance, yet its cost is comparable with fence fabric having shorter life expectancy.

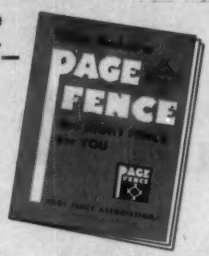
ALUMINUM • Another material in the non-corrosive class. It will not rust nor will it discolor materially under unfavorable conditions. Because of the PAGE method of semi-flat weaving it has exceptional strength.

STAINLESS STEEL • This special chrome-nickel fence fabric is immune to practically all corrosive elements and is particularly advantageous near salt water and where the air is laden with smoke, sulphur or other factory emissions.

MANY STYLES — MANY VARIATIONS • Ready to meet your needs are 8 styles, varied by heights, gauges of fabric wire, units of supporting structure, types of gates (all with welded frames) and barbed wire strands for added security.

ALSO VERY IMPORTANT • The superior quality of materials and the specialized production skills represented by all PAGE FENCE parts are matched by the capable planning and expertness with which your fence will be erected. The Association member firm nearest you will confer with you on all details, offer sound recommendations and submit cost estimates without obligation. This localized firm has continuing interest in every fence it erects.

Write or send coupon for full information. With it we will send name of Association Member nearest you.



PAGE FENCE ASSOCIATION, Dept. W, Monessen, Pa.
Please send me detailed information on PAGE CHAIN LINK FENCE

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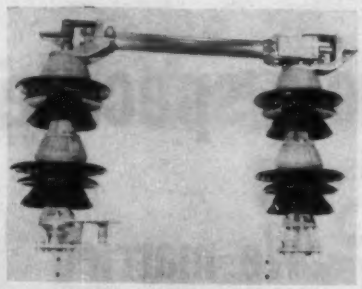
POSITION_____

COMPANY_____

CITY, ZONE & STATE_____

A PRODUCT OF PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE CO., INC.



Side Break Switch . . .

. . . for 2,000 amp has 2 insulators. The group-operated switch is available in standard voltage ratings up to 115 kv. High-pressure line contacts are used. Hinge contact is totally enclosed, permanently lubricated, and designed to eliminate need for flexible braids. Designated R-14B, the switches are applicable for line sectionalizing, circuit breaker by-pass on isolation, and other normal disconnecting switch functions. Available for either horizontal or vertical mounting.
Memco Eng & Mfg Co, Inc, Commack, L. I., N. Y.

Heat-Conductive Ribbon . . .

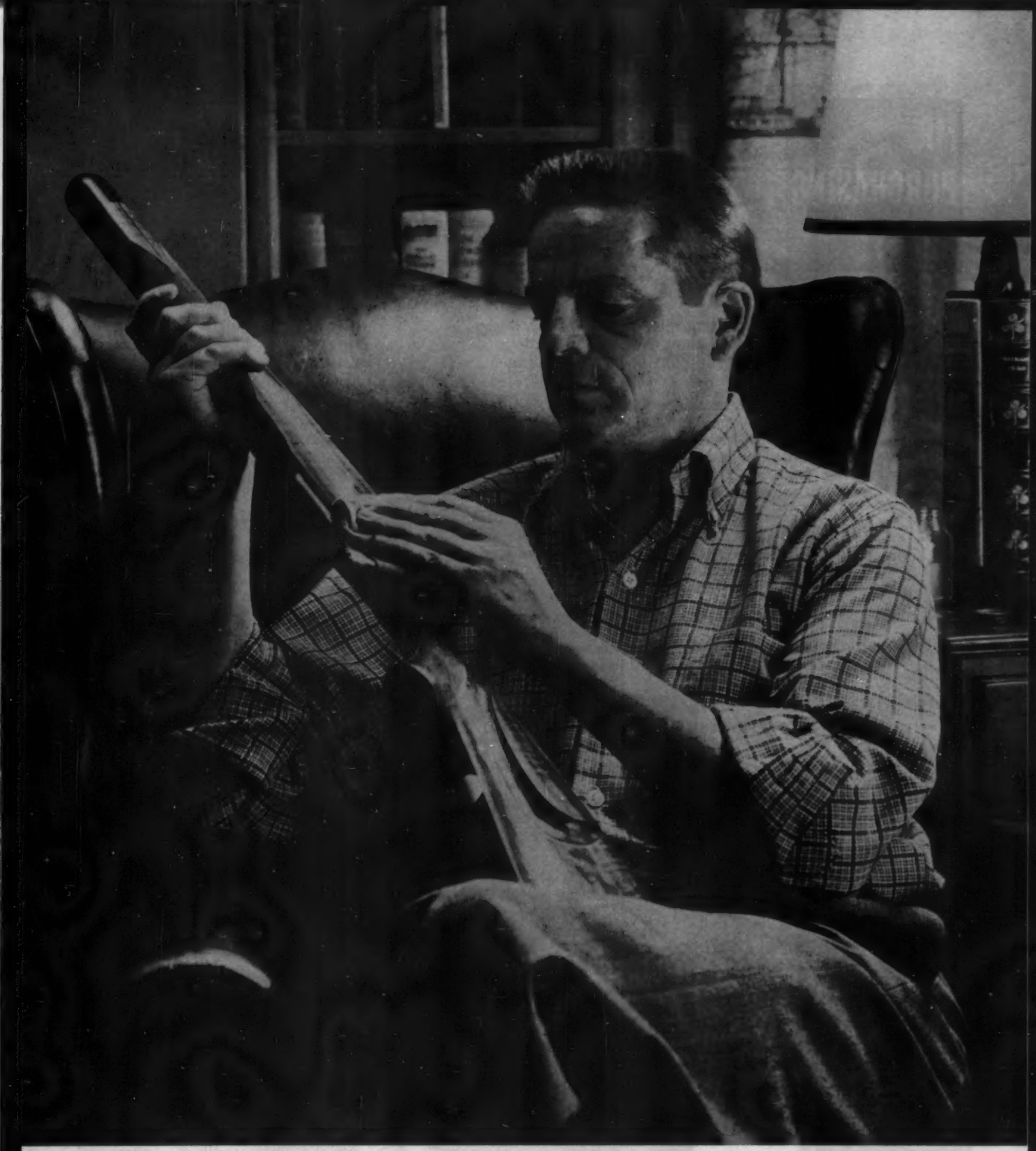
. . . for temperature monitoring of surface areas has negligible thermal lag. High-nickel-alloy wire in flexible outer covering may be cemented to flat or irregular surfaces. Self-adhering types are also available.
Minco Products, Inc, 740 Washington Ave North, Minneapolis 1, Minn.

More New Products

Aluminum **fluorescent area floodlights** feature universal aiming, external ballasts.—Steber Mfg Co, Broadview, Ill.

Lineman's boot laces to toe for added support. It has 17-gage steel shank, leather pole guard over instep, and heavy-weight insole.—Chippewa Shoe Co, Chippewa Falls, Wis.

(*More New Products on Page* 102)



TIME IS THE MEASURE OF ALL WOOD PRESERVATION

In business–as in pleasure–it's important to safeguard your investment in wood. Service records show that AMCRECO pressure treatment still provides the longest and most practical protection.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

MR. PURCHASING AGENT:

WHAT DO YOU KNOW ABOUT RT&E?

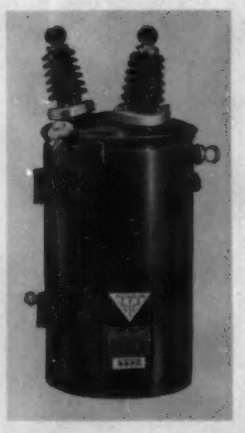
As one of the important men who supply power to America, you should know something about one of America's leading suppliers of power equipment.

While we are not the largest transformer builder, you will find us one of the most dependable. We know that you consider more than cost, that you require an extra measure of dependability and service from your suppliers. That's why you'll want to know more about RT&E.

You should know that *only* our transformers are guaranteed for *five full years* of service. And that RT&E is never too busy or standardized to build *exactly* what you want.

You should know that we maintain warehouse stocks for prompt delivery in your area, that our sales staff is trained and ready to assist you.

Next time you purchase transformers, consider RT&E. It will pay with *more* than money.



RT&E CORPORATION
WAUKESHA, WISCONSIN

Equipment to help provide power for America

Running **torque tester & dynamometer** for fractional-hp motors is automatic except for loading and unloading. It can run six tests on a motor in 21 sec.—John Chatillon & Sons, 85 Cliff St, New York 7, N. Y.

Silicon carbide **heating element** builds up resistance at a gradual, uniform rate. It can be used in continuous applications requiring temperatures up to 2800F.—The Carborundum Co, Globar Div, Box 339, Niagara Falls, N. Y.

Sealed-beam **standby & emergency lights** for substations get power from dry battery. Standby light cuts in automatically when power fails. Emergency light furnishes 2½-hr continuous illumination. — Clean Sweep Co, 6534½ Whittier Blvd, Los Angeles 22, Cal.

Incombustible material with high dielectric strength is suitable as electrical component. "Asbestolux" also resists rot, mold, and vermin. —North American Asbestos Corp, 141 W. Jackson St, Chicago 3, Ill.

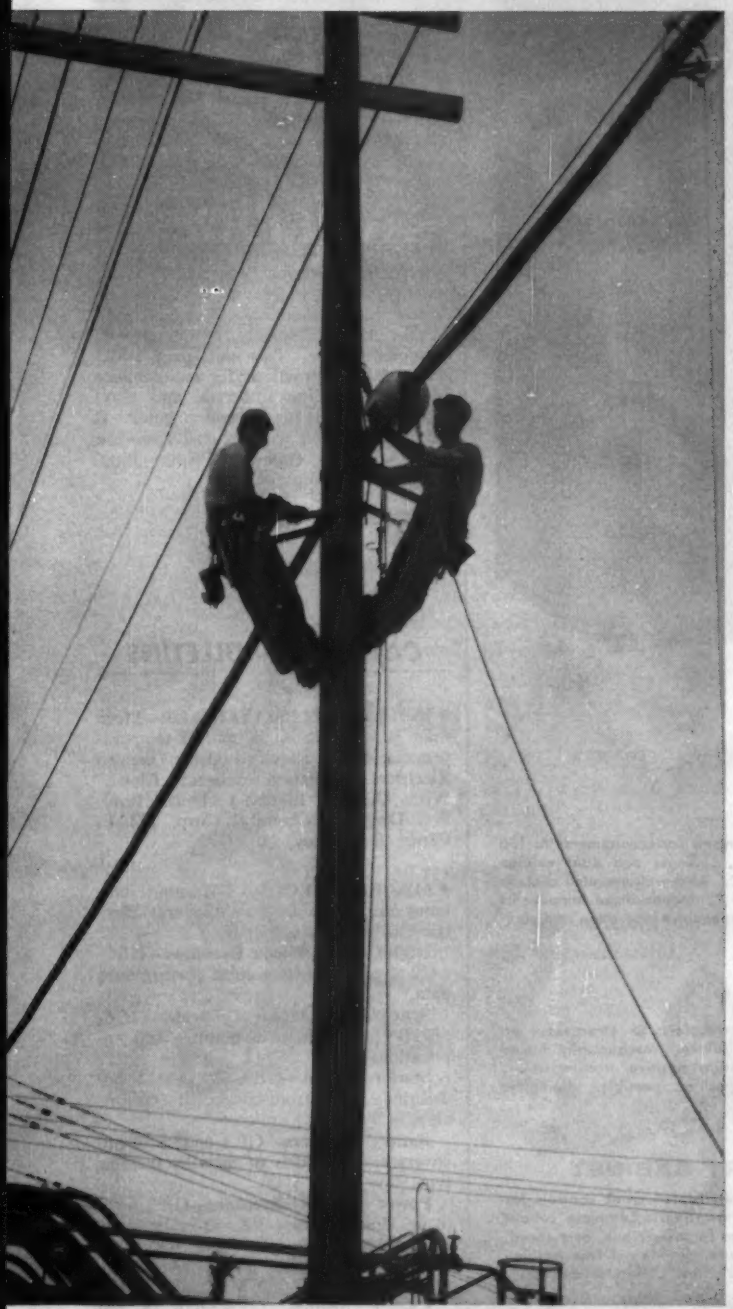
Multimeter has mirrored scale to eliminate parallax, offers 44 ranges. Sensitivity is 20,000 ohm per v dc, 5,000 ohm per v ac,—Precision Apparatus Co, Inc, 70-31 84th St, Glendale 27, L. I., N. Y.

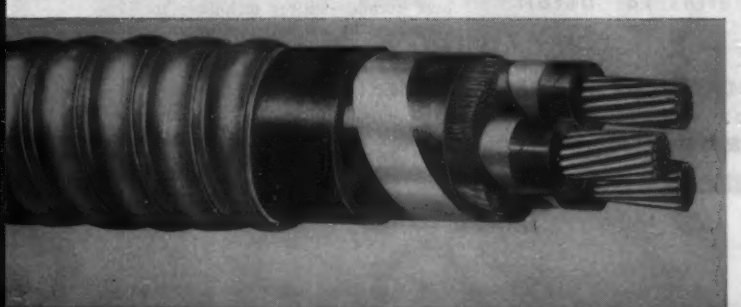
Repeating timers with dial cycles from one rpm to one rph allow for setting of many schedules within a single dial revolution period.—Tork Time Controls, Inc, Mount Vernon, N. Y.

Explosion-proof, dust-tight, raintight **circuit breaker enclosures** protect breaker frames from 100-amp, 250-v ac maximum to 225-amp, 600-v ac maximum. The compact ferrous-alloy enclosures are cadmium-plated throughout, qualify for use in hazardous locations.—The Pyle-National Co, 1334 N. Kostner Ave, Chicago 51, Ill.

Silver-graphite, silver-nickel-graphite, silver-tungsten-graphite, and copper-graphite powdered metal compositions have joined the line of Gibsiloy graphite-based **powered-metal contacts.**—Gibson Electric Co, Delmont, Pa.

Speed new power on old poles—cut costs
with Anaconda Duralox Interlocked-armor Cable





METAL TAPE ARMOR AFFORDS HIGH PROTECTION AGAINST DAMAGE—NO CONDUIT NEEDED.

When a large Gulf Coast refinery needed additional power, the job was done *quickly* and *economically* because Duralox* could be strung on existing power-line poles—below the old lines. Neither new poles nor cross-arms were needed.

Installation time and costs are slashed with Duralox. Outdoors or in, it is readily trained around or over machinery, beams, piping and other obstructions in long, unbroken runs.

Duralox increases plant flexibility, affords easy maintenance and minimizes down time because it is generally accessible, easily relocated—100% salvageable. *Reg. U.S. Pat. Off. 57497

NEW BULLETIN DM 5606 contains full information about Anaconda Duralox Cable. Write for your free copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

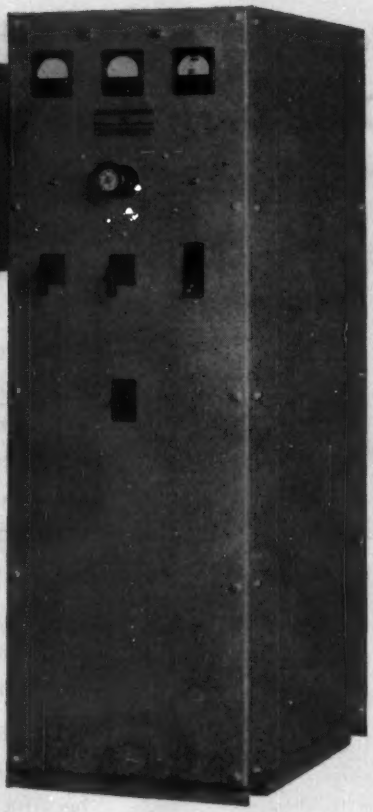
Ask the Man from

ANACONDA®
for DURALOX CABLE

EXISTING POLES are utilized at well-known refinery for additional power. Cable is Anaconda's 4/0 Awg Duralox Interlocked-armor Cable.

DURALOX CABLE is available in sizes No. 6 Awg to 750 Mcm—copper or aluminum conductors with rubber, plastic, or varnished-cloth insulation—up to 15kv. Underwriters' approved for 600 volts and 5000 volts, varnished-cloth insulation, galvanized steel armor!

New CAB
New ECONOMY
New VERSATILITY



DIESEL GENERATOR *Control*

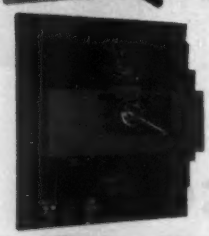
This new compact floor mount generator control cabinet occupies only 5 sq. ft., and is designed for both single generator standby service and multiple set parallel operation. It is available for ratings to 250 KW, 480 V.

Instrumentation employing large-full-view meters is conveniently located at eye level. Standard parts including molded case circuit breaker, voltage regulator, and transformers assure dependable operation plus servicing convenience.

Specify current requirements for cost-saving details.

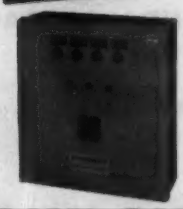
TOP MOUNT

Engine-mounted controls for requirements to 150 KW, 480 volts . . . Single and dual voltage service, A.C. or D.C. Also wall-mounted controls to 75 KW, 220/480 V. Standardized components and circuitry for dependable operation and service convenience.



TRANS-O-MATIC

Automatic switch transfers to emergency on failure of normal source. Mechanically linked circuit breakers assure positive transfer . . . with no neutral position possible. Complete relay protection.



ENGINE START CABINET

Single and 5-shot interrupted crank controls for dependable engine starting. Complete cut-out and alarm protection for over-crank, over-speed, low-oil, and water-temperature. Four-position operation "automatic", "test", "manual" and "off"

Request Bulletins For Detail

LAKE SHORE *Electric* **CORPORATION**
207 WILLIS STREET
BEDFORD, OHIO

TECHNICAL LITERATURE

WOOD PRESERVATION—Two new and 12 revised standards for the "AWPA Manual of Recommended Practice" have been sent out to purchasers of the manual. Included are standards for preservative treatment of crossties by both pressure and non-pressure processes, and addition of pentachlorophenol in standards for treatment of certain poles. The "AWPA Manual" is obtainable from the American Wood-Preservers' Association headquarters, 839 Seventeenth St, NW, Washington 6, D. C. Price is $8.50 plus postage.

STANDPIPE & HOSE SYSTEMS—A safety code covering "Inspection, Maintenance, and Protection of Standpipe and Inside Hose Systems" has been published by the Fire Equipment Manufacturers' Association, Inc. This eight-page booklet contains instructions for maintenance of hose, couplings, nozzles, and playpipes as well as an inspection guide. It may be obtained without cost from the publisher, One Gateway Center, Pittsburgh 22, Pa.

CATALOGS–BULLETINS

• **INSULATION MATERIALS:** More than 30 types in A, B, and H temperature classes are described on the "Electro Electrical Insulation Selector Chart." Write Dept A, Electro-Technical Products Div, Sun Chemical Corp, 113 E. Centre St, Nutley, N. J.

• **MISCELLANEOUS:** Following bulletins are available from General Electric Co, Schenectady 5, N. Y.:

High-Current Silicon Rectifiers—GEC-1470 (2 pp) includes graphic performance data.

Synchronous Motor Controls—GEA-5873B (8 pp) discusses features and applications.

Starter-Control—GEA-6331A (12 pp) describes the front-connected "Limit-amp."

Battery Chargers—GEA-6525A (4 pp) covers seven models of metallic rectifier type.

Power Circuit Breakers—GEA-6599 (8 pp) describes type FK, 69-kv breakers rated 1,000, 1,500, 2,500 Mva; 600-1,200 amp. GEA-6600 (8 pp) covers those rated 3,500 and 5,000 Mva, 2,000 amp.

Carbon Brushes—GEA-6688 (8 pp) uses question-answer technique to illustrate how to get best performance from brushes.

Dc Power Supplies—GEA-6690 (6 pp) describes tailor-made systems for computer applications.

Master Switches—GEA-6705 (2 pp) gives data on general-duty type. GEA-6706 (8 pp) covers heavy-duty switches.

NEW

No. 53-XPJ Nicopress Tool with *Three Grooves*

Accommodates Nicopress Sleeves

FOR COPPER

1 solid, 1 seven strand, 2 solid, 2 seven strand, 2 three strand, 3 solid, 4 solid, 4 seven strand, 4 three strand, 6 solid, 6 seven strand, 8 solid, 8 seven strand, 3 No. 10, 3 No. 8.

FOR COPPERWELD

4A, 6A, 8A, 6C, 8C, 6D, 8D, 9½D, 3 No. 10, 3 No. 12, 4 solid, 6 solid, 8 solid, 10 solid.

FOR ALL-ALUMINUM

2 solid, 2 seven strand, 4 solid, 4 seven strand, 6 solid, 6 seven strand, 8 solid.

FOR AMERDUCTOR

8SCP or SCG, 10SCP or SCG, 12SCP or SCG.

Write for descriptive folder.

Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and foreign countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

When TROUBLE Strikes

call NATIONAL

The two photos above show a typical example of copper growth which is a common cause of trouble in turbo generator rotors. Note the displacement of the top turns of the field winding. NATIONAL uses silver-bearing, surface hardened copper to minimize copper growth because it has a higher strength at elevated temperatures and resists the effect of heat cycling. The photo below shows coils being inserted in a turbo generator rotor at NATIONAL'S Columbus Plant.

for...

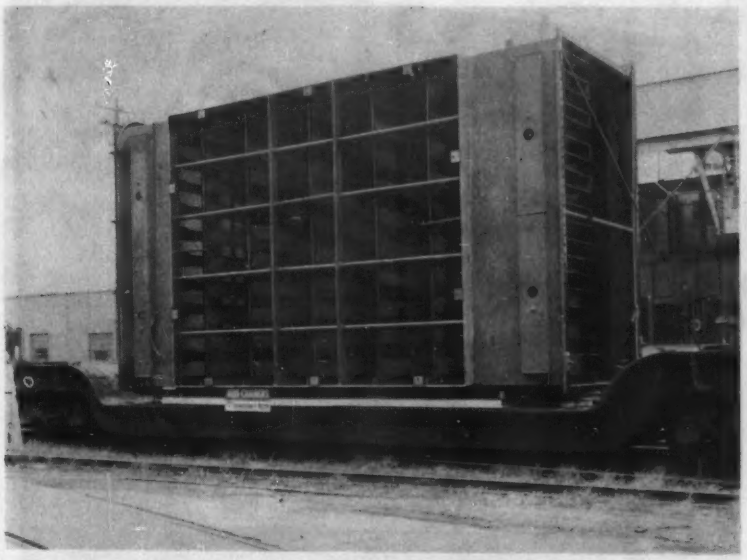
- fast rewinding service for minimum downtime
- high quality repairs to minimize future trouble
- redesign, where practical, to eliminate the cause of trouble

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

TRADE MARK

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES



Calectric Gets Giant A-C Condenser

California Electric Power Co is the destination of this 42,500-sq ft condenser, largest ever shipped in one piece by Allis-Chalmers Mfg Co.

Because of its size—19 ft 1½ in. from rail to top of load and 9 ft 7 in. wide—the shipment was permitted to travel from West Allis, Wis., to the West Coast only during daylight hours at speeds of no more than 15 mph and with no on-coming rail traffic.

The condenser was unloaded at Highgrove and trucked to Marigold, Cal., site of the new San Bernardino power plant. The rail shipment took 20 days.

Babcock & Wilcox Making Boiler for Duquesne Light

Babcock & Wilcox Co will furnish the boiler for a $30-million steam-electric generating unit to be installed at the Duquesne Light Co's Elrama, Pa., Power Station. Steam will be supplied for a 172,000-kw turbine-generator.

Planned as part of an over-all station expansion and improvement program, the boiler and turbine-generator will be the largest erected in western Pennsylvania. This addition is expected to be in operation during the winter of 1959-1960.

The steam generator will have a maximum continuous steam output of 1,300,000 lb per hr. Designed for a pressure of 2,150 psi, the boiler will operate with a pressure of 1,900 psi at the superheater outlet with both steam temperature and reheat temperature at 1,000F. B&W also will build five pulverizers for the boiler, which will burn approximately 75 tons of coal hourly.

Blaw-Knox Awarded Johnsonville Piping

Blaw-Knox Co, Pittsburgh, Pa., was awarded a $3.5 million contract for power piping systems. The piping will serve four 150 Mw steam power units in the Johnsonville, Tenn., power plant of Tennessee Valley Authority.

Piping will be 2.25% chromium, 1% molybdenum steel; main steam portion will be 14-in. OD with 2.3125-in. walls, and some, 10.75-in. OD with 1.75 in. walls.

Erection for first unit (seventh for the plant) began in October, 1957, and completion for the plant's tenth unit is about June 1959.

Canada Fights for Its Own Heavy Equipment Market

On importation of electrical equipment—What progress, if any, has been made towards the easing of the situation created by the importation of foreign equipment?

Reporters asked this question of R. D. Harkness, retiring president, during the recent annual meeting of the Canadian Electrical Manufacturers Association.

Harkness said "Foreign competition is still a major factor in the heavy electrical apparatus business. Apart from thermal generating equipment, the amount of heavy apparatus business secured by overseas manufacturers this year has been less than in previous years. This has not been because foreign manufacturers have been less active, but due to the fact that Canadian manufacturers, by aggressive cost and expense reduction programs, have been able to match foreign prices in most instances. Recognizing that a substantial wage differential still exists between Canada and Europe, this is a real achievement on the part of Canadian manufacturers. In the U. S., where wages and material costs are more comparable to Canadian costs, electrical apparatus prices are, in general, considerably above Canadian. This combination of meeting European prices with a cost structure comparable to the U. S. continues to hold profit levels in the heavy electrical apparatus industry to a low level, a level so low that it is difficult, in many cases, to justify engineering development projects and expansion of facilities.

"The competitive position of electrical manufacturers depends upon a combination of material costs, labour costs and the productivity of Canadian labour as compared with the laid down cost in Canada of foreign products. While productivity in the Canadian industry has increased rapidly during recent years, its increase has been outstripped by increases in labour costs and by the factors already mentioned which have encouraged imports."

(*More M & M on page* 100)

0 50 100 150 250 300

Automatically monitor all low and high temperatures

with the *ElectroniK* scanning system

Save the cost of using individual instruments to monitor plant temperatures. Use this efficient, highly flexible *ElectroniK* system for continuous, automatic scanning. With this one unit you can monitor hundreds of temperature points—record temperatures in boiler tubes, drums and feed pumps . . . fan, turbine and generator bearings . . . transformers . . . hydrogen cooling systems.

Important operating advantages of the *ElectroniK* scanning system include:

Flexible operation of printing system—

- temperature recorded only when set point is exceeded
- continuous recording
- no recording but continuous scanning
- only manually selected points recorded and/or scanned

High scanning rate—3 seconds per point

Independent set point—provided for each bank of nine points

Indicator lamps—identify point of measurement

Synchronism between scanning and printing—if lost during manual manipulations, synchronism is automatically restored

Scanning is uninterrupted—by printing or alarm functions

Sensing elements—low cost thermocouples used

For complete details, call your nearby Honeywell field engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

First in Controls

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

Fischer & Porter Makes Recorder for Station Use

Fischer & Porter Co of Hatboro, Pa., has developed a high-speed sequential operations recorder for generating stations and sub-stations.

The Millisecond Operations Recorder (MOR for short) automatically records all equipment operations sequentially on a printed digital tape. This aids in analysis of upset conditions. Completely transistorized, the MOR system measures time differences of 10 milliseconds between events.

W. L. Jackson Co's Sales Up 1,000% in 10 Years

A business increase of 1,000% in 10 years is the record chalked up by the W. L. Jackson Mfg Co, Chattanooga, Tenn. The gross sales increase was from about $200,000 for the first year to an expected $2 million by the close of 1957, noted W. L. Jackson, president, in reviewing the firms 10 years of operation. Principal products are electric water heaters and well-type air heaters for domestic and commercial purposes.

The company started manufacturing the heating equipment with 9 employees in a 30 x 50-ft shop and continued there for four years. In its gradual expansion, the company to date has 65 employees and a plant area of about 43,000 sq ft plus a large storage yard.

A new product planned is a three-element water heater in tank capacities of 40-120 gal.

U. S. Copper Production

Primary copper production in the United States, according to a report by the Copper Institute, New York, for the month of September amounted to 87,053 tons, down from 89,680 tons in August. Refined copper production for September was 117,078 tons, a decrease of 11,402 tons from the preceding month. Deliveries to fabricators totalled 102,925 tons, compared to 107,522 tons for the prior month. Refined copper stocks for September was only 176,813 tons.

Uptegraff Transformers

Dry-type, silicone-insulated, distribution transformers in 10 to 100-kva capacities will be marketed in about two months by R. E. Uptegraff Mfg Co, Scottdale, Pa. This dry-type known as Class DH (single-phase) and DHT (three-phase), will supplement the Class DB and DBT ventilated dry-type units.

Westinghouse Developments

Fan installation, large and small motors and circuit breakers are among the recent apparatus developments.

• Ten induced draft fans are in operation at the Ohio Valley Electric Corp's (OVEC) Kyger Creek Station at Cheshire, Ohio. They are installed in five double units and are capable of moving 2.5 million cfm air. These fans are a product of the Sturtevant Division, Hyde Park, Mass.

• About $700,000 worth of electrical equipment is being furnished for a 200-ft long by 50-ft wide "cutter-type" dredge for the Utah Construction Co. Included is a suction-pump 8,000-hp motor being built at Sunnyvale, Calif., and an augur-drive 2,000-hp motor being built at East Pittsburgh, Pa.

• Available is a 13.8 kv, one-million kva magnetic type air circuit breaker for use with metal-clad switchgear. This rating extends the present line of DH breakers. Units are being produced for two utilities.

• Some very shakey motors have been designed for use with vibrating screen separators produced by Southwestern Engineering Co. These "Rock 'n Roll" motors have eccentric weights on both ends of the shaft to vibrate the screens.

• To service and repair apparatus, a plant will be started this December in Glassport, Pa.

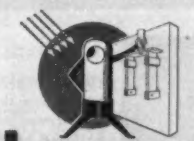
(*More M&M on page* 112)

DEPENDABLE OUTDOOR LIGHTING CONTROL

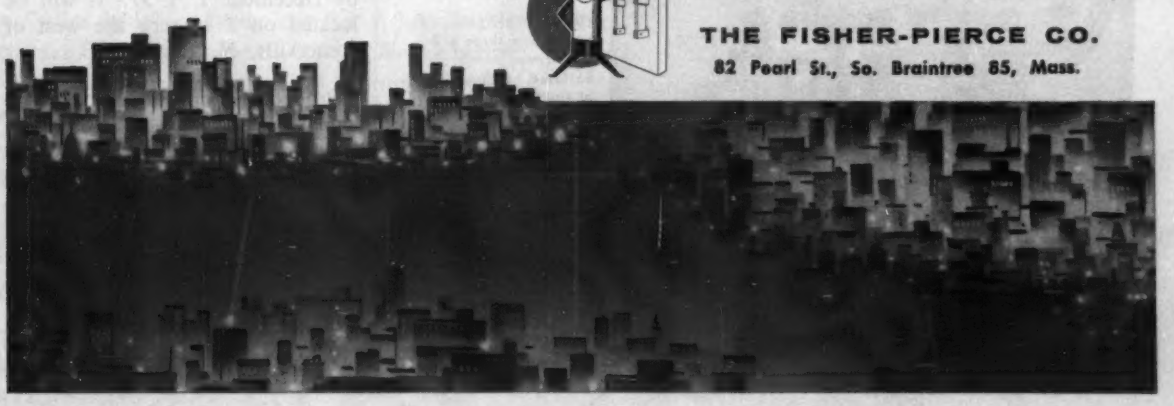
.....from coast to coast

Throughout the United States, Fisher-Pierce units have provided more hours of dependable street light control than any other make of photoelectric control. For more than twelve years Fisher-Pierce has set the pace in the development and manufacture of photoelectric controls for all types of outdoor lighting.

Today Fisher-Pierce, backed by an organization of 600 people, offers unlimited facilities for the development of new controls and allied products for the electric utility industry . . . as well as the extensive service organization that stands behind each F-P control. Whether your requirements call for proven lighting controls for any type of outdoor lighting, development of new electric or electronic products, or engineering service in the installation and maintenance of lighting control systems . . . call on Fisher-Pierce.



THE FISHER-PIERCE CO.
82 Pearl St., So. Braintree 85, Mass.



ANCHOR

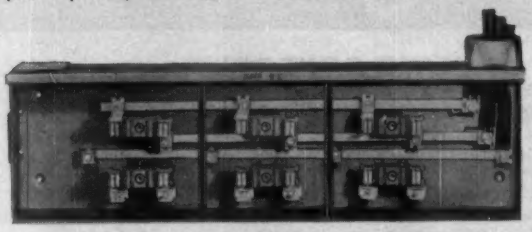
LARGER OUTDOOR HORIZONTAL METER TROUGHS

To supply 100 ampere service capacity to each dwelling unit in multiple family buildings Anchor offers new large outdoor horizontal troughs. Width, height, and depth are substantially increased over present industry standards with emphasis on added room at the ends where the cables enter the trough.

On the 3100-ME series, 4" is added to end of first and last meter positions and special line terminals are furnished with the bussed troughs which are interchangeable in the field to permit the entrance at left top or side and the right top or side. Hubs, or hub openings with sealed tamper proof plates, for 2½" conduit can be located at these four positions

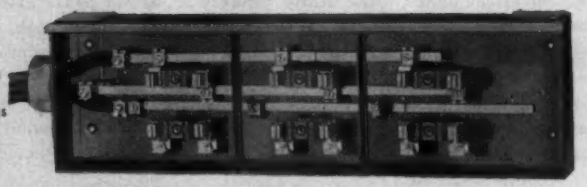
Line terminals are open top and will carry 4/0 cable in addition to adequate buss bars Pressure foot terminals available

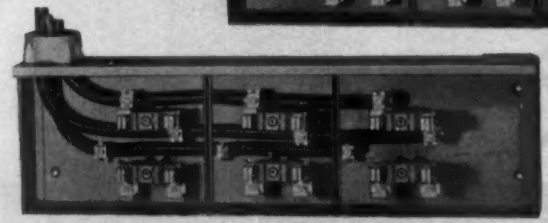
Troughs are made two to six gang, with or without busses and of galvanealed steel or aluminum



CAT. No. 3373-ME
Bussed and wired with three 4/0 at right top.
Enclosed hub openings at left top and side

CAT No. 3373-ME
Bussed and wired with three 4/0 at left side.
Enclosed hub openings at left and right top





CAT No. 3173-ME
Wired with three 4/0 at left top.
Enclosed hub opening at right top

Vertical channels for covers are removable for ease of wiring

ANCHOR MANUFACTURING CO.
MANCHESTER, NEW HAMPSHIRE

PLANT EXPANSIONS

• For power components and hardware manufacture and research, Fargo Mfg Co, Inc, is building a two-story addition to their plant, at Poughkeepsie, N. Y. Completion is scheduled for the beginning of 1958.

• A research and development center now being designed for Leeds & Northrup Co will provide about 65,000 sq ft of floor space. It will be erected in Upper Gwynedd Township, Pa., near the firm's automatic-controls plant completed there last year.

• Production space of Electric Machinery Co, Minneapolis, Minn., will be increased by 100,000 sq ft upon completion of a building now under construction there.

• Space for advanced research in electronics and lighting will be nearly doubled by a million-dollar addition to the physics laboratory of Sylvania Electric Products Inc, at Bayside, N. Y. The 34,000-sq ft wing will be completed in the summer of 1958.

• Their eighth electrical assembly plant since 1951 has been completed by Square D Co in Atlanta, Ga. The 31,000-sq ft plant involves an investment of over $500,000.

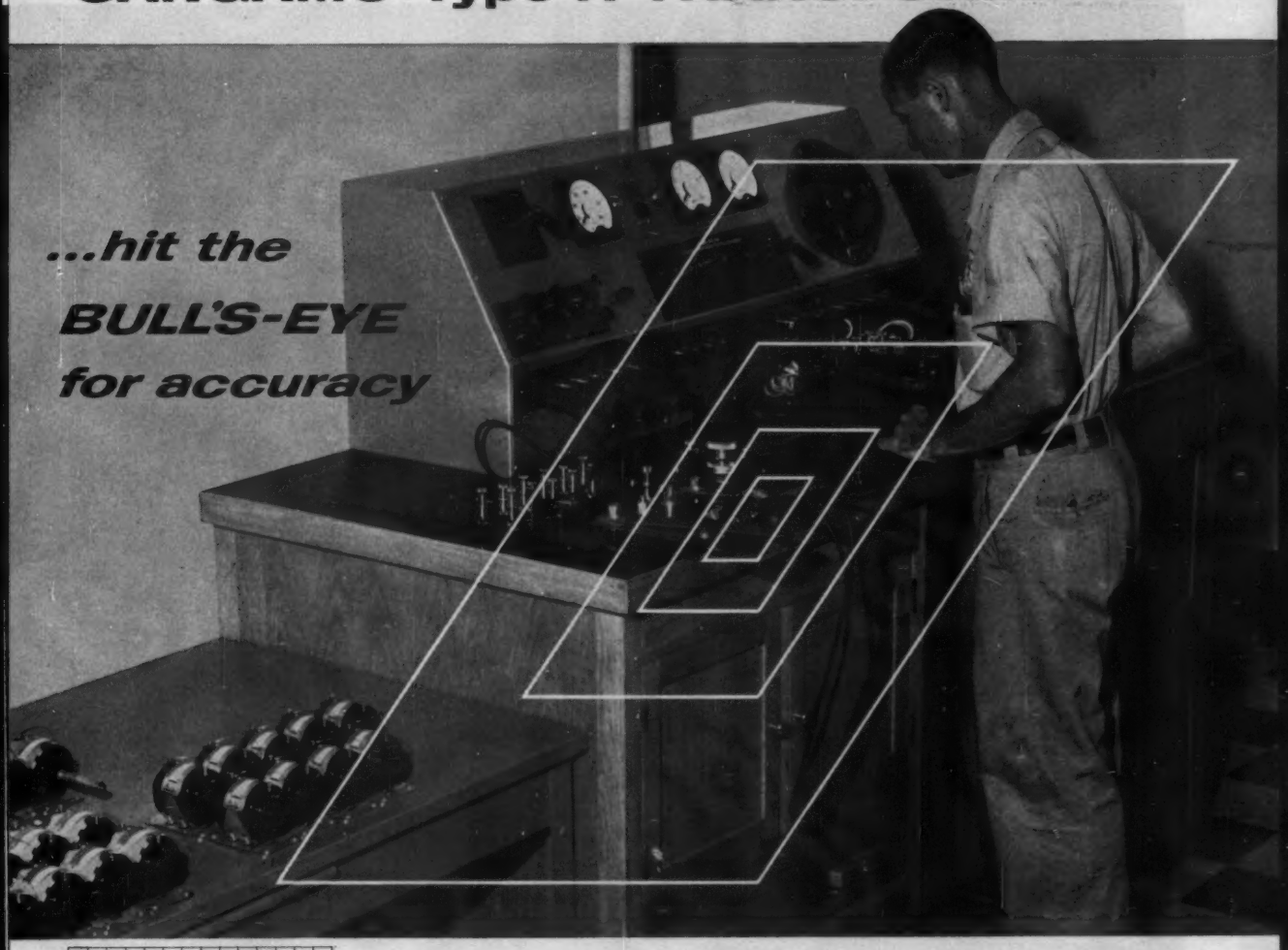
• To expand production of overhead cranes, excavators, and soil stabilizers, Harnischfeger will build a 300,000-sq ft plant at Dubuque, Iowa. Construction is scheduled to begin in the spring of 1958.

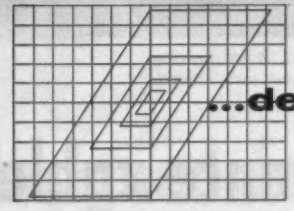
• The first eastern warehouse and sales office of Rea Magnet Wire Co, Inc, is expected to be in operation by December 1, 1957. It will be located on a 10-acre site west of Somerville, N. J.

• Production of linear polyethylene is Dow Chemical Co's objective in building a multi-million dollar plant at their Bay City, Mich., division. Scheduled completion date is October 1958.

• For additional aluminum and steel capacity, Joseph T. Ryerson & Son, Inc, has opened a 250,000-sq ft plant in Boston's Allston district acquired from Arthur C. Harvey Co.

SANGAMO Type R TRANSFORMERS





...designed to fall within 0.3 accuracy class

Sangamo Type R Current Transformers pass utility company acceptance tests with flying colors because they are "tailor-made" to better the 0.3 A.S.A. Standard Accuracy Classification for B—0.1 and B—0.2 burdens.

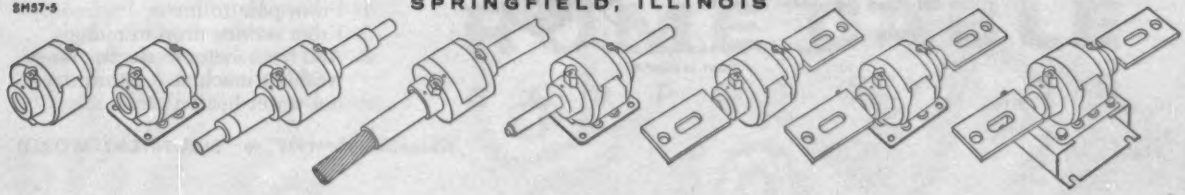
They are light enough to be supported by only the primary conductor. They are adaptable enough to lend themselves to a great variety of simple, economical installations. The eight variations sketched below permit numerous arrangements to meet almost any form of connection. Your engineers can use their ingenuity to devise simple, cost-cutting, installations.

Ask your Sangamo Representative or write us for Bulletin 570 for detailed information on how these economical transformer metering units can provide flexibility for growing loads.

SANGAMO ELECTRIC COMPANY

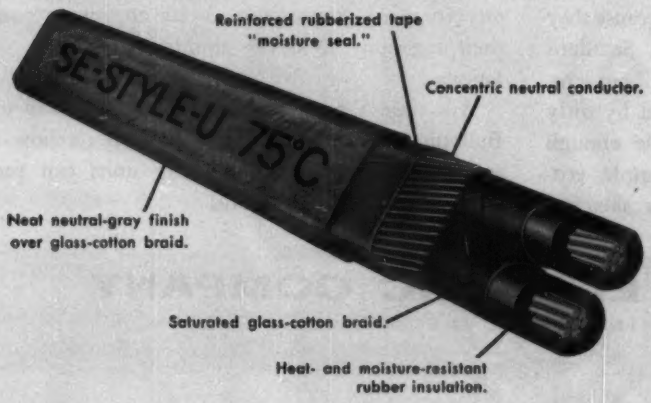
SPRINGFIELD, ILLINOIS

SM57-5



Neither heat nor rain will damage this installation of Rome Service Entrance cable. Easy to work, the cable permits neat installations.

New Rome service entrance cable


Reinforced rubberized tape "moisture seal."
Concentric neutral conductor.
SE-STYLE-U 75°C
Neat neutral-gray finish over glass-cotton braid.
Saturated glass-cotton braid.
Heat- and moisture-resistant rubber insulation.

Rome's new and improved Type SE service entrance cable is the ideal selection for new and re-wired 100 ampere service. It fully meets all the requirements for a service entrance cable that can handle all the electric appliances and air conditioning needs of modern living.

In addition, this versatile cable may enable you to reduce warehouse inventory levels and the amount of cable carried in your service trucks. The same cable can be used:

1. From pole to meter
2. From service drop to meter
3. And from meter to electric range, washing machine, clothes dryer, hot water heater, etc.

Rome Type SE service entrance cable can be used: 1. From pole to meter; 2. From service drop to meter; 3. From meter to electric range, etc.

designed for modern 100 ampere service

Other features of Rome's Type SE cable include:

1. The outer glass-cotton braid is finished to give the cable a neat appearance without sacrificing flame and moisture resistance. This neutral gray finish can be painted, if desired, to match the color of the building on which the cable is installed. It withstands severe storage and service conditions without deteriorating and becoming tacky.
2. The glass-cotton braid on each conductor—one red and one black—is clean, permanent, and provides easy conductor identification. For easy and positive exterior identification, the outside of the cable is surface printed "SE-Style U 75°C."
3. Underwriters' approved for 75°C. operation in *either dry or wet* locations. A reinforced rubberized tape under the weather-resistant outer braid puts the assembled conductors in a "dry location." In addition, the moisture seal provides added protection against cutting by clamps and other fittings, increasing service life.
4. In three conductor construction for 100 ampere service, Underwriters' approval makes possible the use of size 3 AWG copper conductors, or two conductors of size 3 AWG with a neutral conductor of size 5 AWG.

Specify Rome service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 365-A and ask for Bulletin SE-1. Rome Cable Corporation, Rome, N. Y.

ROME CABLE

CORPORATION

Wendel Rises to VP Post

Alabama Power Co has announced the recent election of D. D. Wendel as a vice president of the company.

Wendel comes to his new position after having served as manager of transmission and distribution for the past five years. A 30-year veteran with the utility, he joined Alabama Power in 1927 as a junior engineer, shortly after gaining his degree from Alabama Polytechnic Institute.

Since that time he has served in positions of increasing responsibility, including assistant district superintendent at Montgomery, district superintendent at Tuscaloosa, and manager of the utility's Western Division.

D. D. WENDEL

OG&E Advances Haswell

Andrew J. Haswell, vice president in charge of personnel for Oklahoma Gas & Electric Co, has been appointed to the newly created position of vice president and assistant general manager.

In his new capacity he will coordinate the activities of the generation, engineering, construction, transmission-distribution, rate, and personnel departments.

Haswell joined the utility in 1929 on a full-time basis upon graduating from University of Oklahoma. In 1930 he was made a clerk in the accounting department and remained in that post until 1943, when he rose to Western Division accountant. Two years later he became the division's assistant auditor. He was advanced to director of personnel administration in 1946 and was given the additional title of vice president earlier this year.

ANDREW J. HASWELL

Hartman Is Elevated to PA

Arthur J. Hartman is newly elected purchasing agent of Northern Indiana Public Service Co. His appointment fills the vacancy created by the November 1 retirement of Arthur F. Lindeman, who has been with the utility for 45 years.

Hartman, who has served as assistant purchasing agent since 1937, has devoted most of his 33-year NIPSCO career to the purchasing department. Before joining the department in 1928 as a buyer, he had served as a clerk and as assistant to the general superintendent in the Hammond office. His professional memberships include the Public Utility Buyer's Association and the National Association of Purchasing Agents.

He is succeeded as assistant purchasing agent by Joseph H. Waxman, former traffic manager for the utility.

ARTHUR J. HARTMAN

the barrier that gives you 3 definite advantages

in KEARNEY SERV-ENS
SERVICE ENTRANCE SLEEVES

—outstanding compression connectors for splicing all combinations of ACSR, aluminum and copper for service entrances

1. SERV-EN sockets filled with Kearnalex, an inhibitor containing hard metallic particles that break through the aluminum oxide on conductors. As conductor enters socket, Kearnalex is forced evenly over entire area of inserted wire.
2. Barrier stops conductors at proper point, preventing over-insertion of wire.
3. Barrier completely prevents galvanic action between dissimilar conductors.

SERV-EN ADAPTER

Make corrosion-free terminations of aluminum conductors to bronze or copper terminals of transformers, cutouts, capacitors, etc. Exposed bi-metallic joints eliminated. Aluminum sleeve factory-bonded to length of soft drawn copper wire; joint covered with highly weather-resistant plastic. Open end of sleeve Kearnalex-filled, plastic-capped.

Plastic end caps color-coded for quick size identification.

JAMES R. KEARNEY CORPORATION • *General Offices:* 4224-42 Clayton Ave., St. Louis 10, Mo. 386

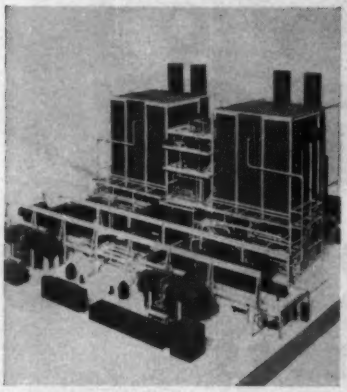
for BETTER CONSTRUCTION
SAFER MAINTENANCE

Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. EUCLID, ONT.

KEARNEY PRODUCTS

The Mark of Quality

A penny saved . . . dime is a ~~penny~~ earned



If your profit is 10% of sales, then a dollar saved on operating costs is equal to $10. of sales. A scale model of your new plant will assure minimum investment, operating and maintenance costs.

Industrial Models, Inc.
(A team of engineers and craftsmen)
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NEW YORK • CLEVELAND • PITTSBURGH
CHICAGO • HOUSTON • DETROIT
NEW ORLEANS • LOS ANGELES
MANCHESTER, ENGLAND
THE HAGUE, HOLLAND

Swedenborg Is New Sales VP

Benjamin Electric Manufacturing Co has elected A. E. Swedenborg as vice president in charge of sales.

An active figure in the firm's outside sales for over 30 years, Swedenborg most recently served as general sales manager. His previous experience includes over 14 years in a representative capacity in Michigan, and then stints as Central Division sales manager and assistant general sales manager. He has also held posts in the purchasing, production, and service departments.

U. S. Rubber Ups McGovern

John W. McGovern, executive vice president of United States Rubber Co, has been advanced to president and chief operating officer. As president he replaces H. E. Humphreys, Jr, who continues as board chairman and chief executive officer.

McGovern, who became a director and member of the executive committee in 1951, formerly held various executive, industrial engineering, and production posts.

New group vice presidents are Eugene A. Luxenberger and George R. Vila.

PERSONAL BRIEFS

Ralph C. Mygatt is new supervisor of Dayton Power & Light Co's electric construction department . . . At Detroit Edison Co, **Case D. Baisley** has been promoted to field superintendent, central area-Detroit, in construction and maintenance.

Gulf States Utilities Co has advanced **J. W. Atkins, Jr,** to staff engineer; **B. F. Lott** to administrative assistant of the methods and procedures dept; **Robert M. Craig** to Navasota division engineer; **W. V. Faver, Jr,** to supervisor of customers accounts; **J. W. Hatcher,** to claim adjuster; and **Clinton Calvert** to engineer in the task force.

John M. Madara was recently named superintendent of mechanical construction for Philadelphia Electric Co's Construction Division . . . Mississippi Power Co has appointed **Paul G. Mains** as Meridian Division manager.

Appalachian Electric Power Co's **F. W. Isley** is new supervisor of community development . . . **D. E. Greene** has been promoted to labor relations manager of Duquesne Light Co . . . Public Service Co of Oklahoma has named **Lyon Hatch** area business manager at Hugo and **Hugh C. Smith** district manager at Broken Bow.

Harold A. Kertz was recently named to the District of Columbia's Public Utilities Commission . . . In New Mexico, the Public Service Commission has appointed **Charles H. Nylander** as accountant and **Frederick G. Von Huben** as attorney.

Norman A. Stoll, former Bonneville Power Administration chief counsel, has joined the legal staff of Oregon Public Utilities Commissioner **Howard Morgan.** He will prepare a redraft of Oregon's public utility laws for presentation to the 1959 legislature.

Southern Indiana Gas & Electric Co has given Chief Mechanical Engineer **Arthur M. Guy** added responsibility as general supervisor of all steam electric generating stations.

Atomic Energy Commission recently named **Kenneth A. Dunbar** manager of its Chicago Operations office.

Earl Cole, board chairman of the Cowlitz County (Wash.) PUD, has resigned to become the PUD's managerial assistant and treasurer. His board post has been assumed by **William E. Sailors.**

West Penn Power Co has named **John K. Walter** as manager of its buildings and land department . . . **Shearon Harris** will join the legal staff of Carolina Power & Light Co on Dec. 1 . . . Virginia Electric & Power Co's **William L. DeCamps** has advanced to superintendent for the Peninsula district.

Allis-Chalmers Manufacturing Co has appointed **Philip C. Neumann** as application engineer, Pittsburgh Works . . . At the West Allis Works, **H. F. Twomey, Jr,** was recently made manager of the labor relations section.

Recently elected to membership in Controllers Institute of America were **Louis E. Wengert** of General Electric Co and **Edward J. Colosimo** of Bull-Dog Electric Products Co.

OBITUARY

Arthur E. Bond, 61, chief planning engineer for Pacific Power & Light Co, died recently in Portland. He had been under treatment for a heart ailment.

James W. Hook, 73, chairman of the board of United Illuminating Co, died recently at his Hamden, Conn., home.

E. M. LaBaw, 44, manager of the rates and research department of Central Illinois Public Service Co, died suddenly after a heart attack.

Fred J. Rutledge, 83, a retired vice president of United Gas Improvement Co, died recently in Philadelphia.

Onan ELECTRIC PLANTS

ELECTRIC PLANT NEWS

Onan ELECTRIC PLANTS

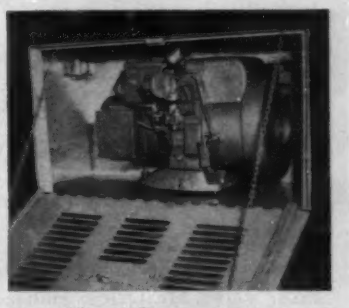
Truck-mounted electric plant cuts costs two ways

Onan Plant provides A.C. power for electric tools and lights, and D.C. output to charge batteries for radio communication.

Utilities using this dual-purpose Onan Electric Plant on trucks report savings ranging from *$2.00 per day* per truck to *$800.00 per year* per truck . . . for the battery-charging feature alone. Before installation of the Onan plant it was necessary to keep the large truck engine running to charge batteries, extremely wasteful from the viewpoint of fuel and engine maintenance.

The Onan plant shown is a Model O7AK, developing 750 watts of A.C. with about 8 amperes for 12-volt battery charging. It is powered by an Onan single-cylinder, air-cooled gasoline engine direct-connected to an Onan all-climate generator in a compact, rigid, long-life unit. A.C. output is sufficient for operation of drills, saws and other tools used for construction and maintenance.

Other vehicular battery charging plants and A.C. models available.



Vacu-Flo cooling system permits enclosed installation

With Onan's Vacu-Flo system, air is drawn (rather than blown) through generator and engine, and discharged through a duct to the outside. An Onan air-cooled plant with Vacu-Flo can be installed in a small compartment within truck or trailer.

Ask your Onan distributor about this dual-purpose unit or write for circular on three battery charging methods.

D. W. ONAN & SONS INC.

2987 University Ave. S. E., Minneapolis 14, Minnesota

Onan ELECTRIC PLANTS

To build load in its area . . .

Patchogue Electric Light Company

Willoughby Oxley, Manager of Operations, studies a pressure-creosoted pole.

"Pressure-creosoted poles are the best value money can buy,"

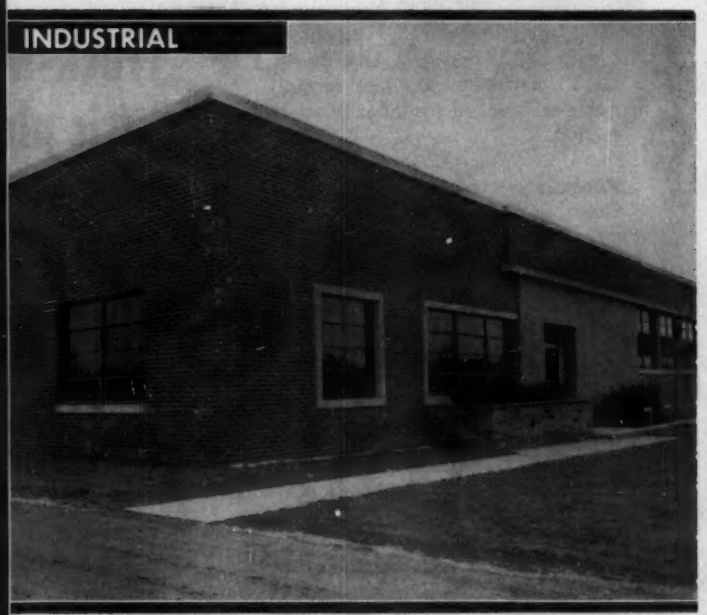
says Manager of Operations

"We first used pressure-creosoted poles in 1924," states Mr. Oxley, Manager of Operations, "and we have purchased nothing else since 1935. Pressure-creosoted poles have proved to be durable and insect-resistant. They have a life expectancy in excess of any kind of pole we could obtain.

"The element I like most is that once a pressure-creosoted pole is in the ground, we just don't bother with it any longer. We know there will be a minimum of trouble. And this is where pressure-creosoted poles pay off—through lower maintenance."

The Patchogue Electric Light Company, Patchogue, Long Island, New York, does not wait for business to come its way. It goes after business. Mr. Ira Rogers, Jr., Manager of Area Development, tells how: Pelco works with the Chambers of Commerce, The New York State Department of Commerce, Town, County, and Village Officials and other civic groups interested in attracting new industry to this area.

Pelco advertises, sends out promotional brochures, maintains contact with industrial realtors and factory-placement agencies and makes personal calls on industrial prospects. Information concerning available plant sites, the labor market, housing, transportation facilities, etc., is compiled for distribution.

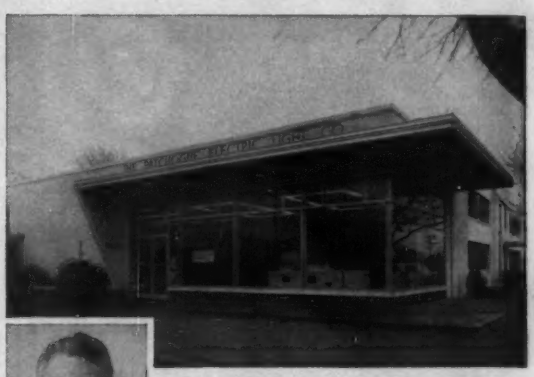


If you would like more information on pressure-creosoted utility poles, and the way they can enable you to save money and establish better service for your utility, just get in touch with the nearest Chemical Sales Office of United States Steel or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

has a many-sided development program

The residential aspect of Pelco's Area-Development activities includes cooperative advertising and promotion of model homes. Home Service personnel work with builders, home owners and appliance dealers in kitchen and laundry planning, lighting layouts and also demonstrate the proper use of electric equipment so the customer can get the most out of this service.

Judging by the progress of The Patchogue Electric Light Company, this intensive area-development program is paying off. In 1950, the company had 14,836 customers and net sales of 33,042,109 KWH. In 1956, there were 21,841 customers and net sales had increased to 73,815,149 KWH.



Headquarters of The Patchogue Electric Light Co., Patchogue, Long Island. Insert shows Mr. Ira Rogers, Jr., Manager of Area Development.

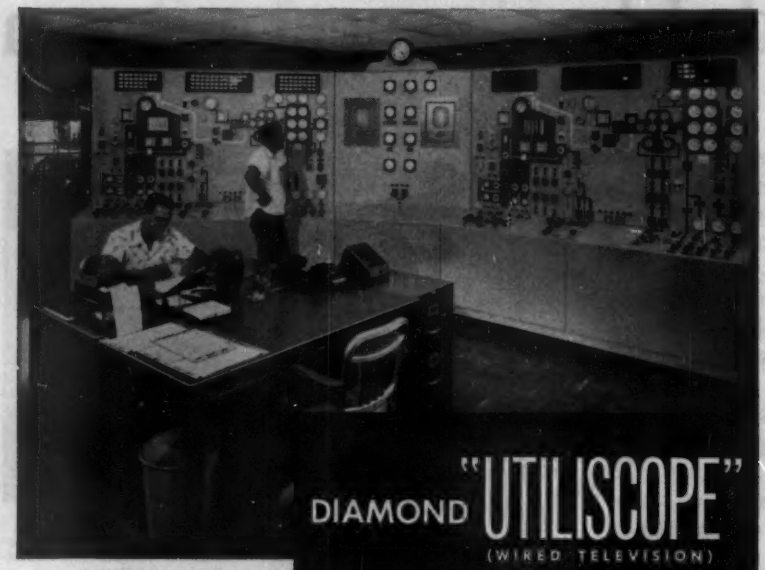
CREOSOTE'S PAST ASSURES WOOD'S FUTURE

USS CREOSOTE

Sales Offices in PITTSBURGH, NEW YORK, CHICAGO, CLEVELAND, SALT LAKE CITY, AND FAIRFIELD, ALABAMA

UNITED STATES STEEL

AUTOMATION IN POWER PLANTS



DIAMOND "UTILISCOPE"
(WIRED TELEVISION)
HEAVY DUTY
EQUIPMENT FOR
VISUAL INFORMATION

"UTILISCOPE" CAMERA

"UTILISCOPE" RECEIVER

The Diamond "Utiliscope" makes possible the ultimate in automation for power plant control. It enables the operator to see clearly anything that requires visual check. He no longer need depend upon indirect interpretations to know what is happening outside his range of vision.

The operator in the above photograph is watching the ITV image of the water level in two boilers . . . transmitted by "Utiliscope" cameras focused on Diamond Bi-Color water gauges. The water levels are easily and unmistakably read on the viewing screens. There can be no error . . . the level is shown correctly or there is no picture.

The Diamond "Utiliscope" is heavy duty equipment for power plant application. Other power plant uses are: watching flame conditions in boiler furnances, watching smoke emission from stacks, and watching remote entrances for intruders. Have you explored the "Utiliscope's" resources for saving money and improving operation? Use the coupon below for further information.

7800

Diamond

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FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
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Since 1903, Diamond has Manufactured Quality Equipment for Industry

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Please send me without obligation a copy of bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs and improve operations.

Name_____

Title_____

Company_____

Address_____

SALES ASSIGNMENTS

COMPANY STAFFS

Alpha Wire Corp has appointed Raymond Ives as Mid-western regional sales manager, with offices in Chicago.

Anaconda Sales Co has designated E. F. Murphy, Jr, as assistant sales manager, with responsibility for aluminum sales, a new post.

Bristol Co's new field representatives for socket screw products are R. E. Helsabeck, Houston; George K. Foster, Cincinnati; and C. A. Rust, Los Angeles.

BullDog Electric Products Co recently named Robert F. James as Eastern region electrostrip sales engineer.

A. B. Chance Co has advanced Dwight E. Argo to regional sales manager for the eleven Western states. He is succeeded as Southwest regional sales manager by Albert B. Goodall. Both appointments became effective about Nov. 1.

Colorado Fuel & Iron Corp's Wickwire Spencer Steel Division has named Earnest J. Bolduc as New England district sales manager and Charles P. Harlow as sales manager, hardware products department.

C & D Batteries, Inc, has appointed Edward H. Gossling, Jr, as salesman in the Baltimore territory, with headquarters in Philadelphia.

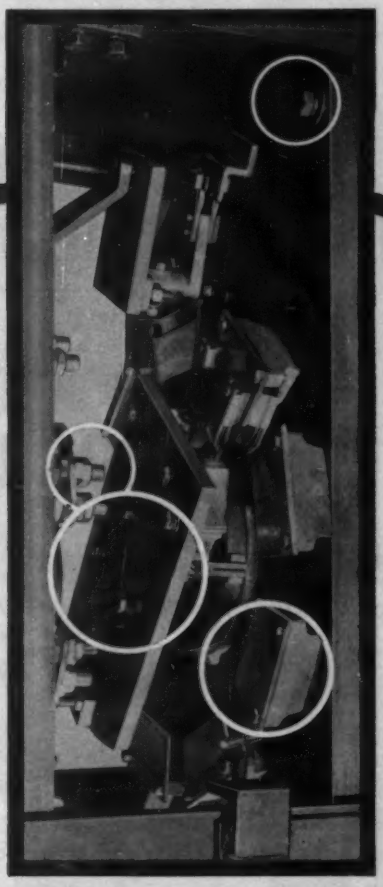
Curtis Lighting, Inc, has designated Charles P. Wallick as sales engineer in the Minneapolis area.

General Electric Co's large steam turbine-generator department has made the following appointments: Daniel J. McLane, Jr, as manager-sales for Region One (Pacific Northwest, Pacific Southwest, Pacific, Rocky Mountain, South Atlantic districts); Daniel J. McLaughlin, Jr, as manager-sales for Region Two (New England, Empire, Atlantic, Allegheny, Michigan, Central districts); Charles W. Billings as acting manager-sales for Region Three (Southeast and Southwest districts, and liaison with Canadian GE and International GE); George B. Cox as acting manager-sales for Region Four (New York, East Central, Mid-states district); and Horace G. Mallett as manager-sales for supply and renewal parts.

Edwin F. Guth Co has named John T. Fite, Jr, as lighting sales engineer for southeastern Pennsylvania, southern New Jersey, and northeastern Delaware.

H. M. Harper Co has designated Donald A. Sanders as Boston district sales manager and Joseph O. Thill Pittsburgh district manager.

Kuhlman Electric Co has promoted Jay G. Gates to representative for southwestern Ohio and Kentucky, with offices in Cincinnati.



reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

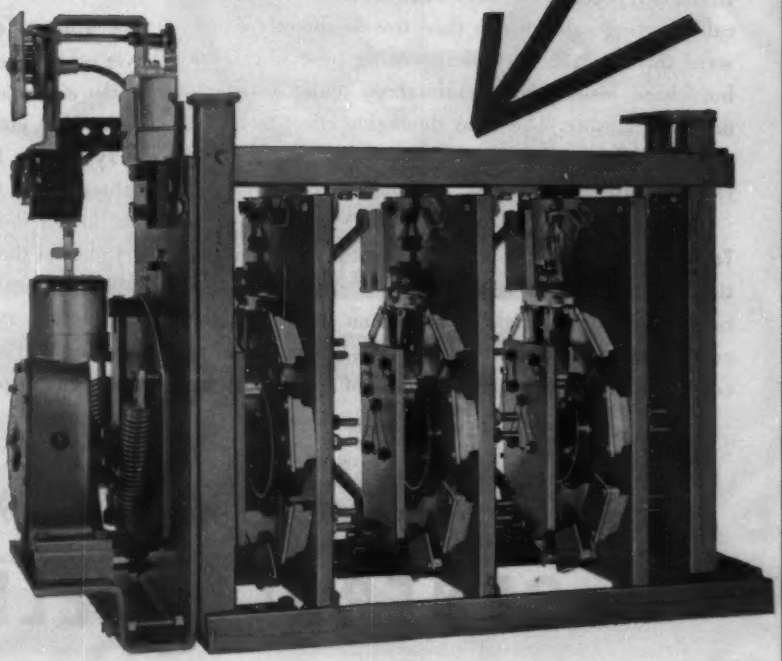
The extra heavy tap-changing mechanism is built to withstand the most severe operating conditions. From the rigid mounting frame of bolted and welded construction down to the smallest component, all parts are sized for long service life. In fact, a unit recently inspected after 20 years' operation showed no appreciable wear.

In addition, the quick-break tap changer operates on balanced spring principle—snubs fast moving parts to quick stop without shock.

Six types of locking devices add to rigidity of mechanism. Wired bolt heads, fine threaded bolts, prick punching, locking strips, lock washers, and nuts are all used to assure rigidity year in and year out.

These are only a few of the many reasons for the remarkable service record of Allis-Chalmers 3-phase regulators. For all the reasons, contact your local A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

rigid mechanism



A-5461

ALLIS-CHALMERS

How vertical vulcanization provides superior quality in butyl-insulated cables

Unique 6-story process, used in making General Electric Super Coronol* cables, helps insure greater uniformity, better concentricity control, and longer life.

Over ten years ago General Electric began to vulcanize its high-voltage Super Coronol cables downward. This basic process is the most effective method of providing you with cables having uniform insulation throughout the entire length.

Vulcanizing vertically downward eliminates the dangers of sagging and deformation encountered in the horizontal, vertically upward, and drum processes. In the G-E process, the large extruder encases the vertically moving cable which then travels directly downward through a 6-story steam-curing tube where the butyl-base insulation is maintained under constant, uniform pressure. Thus, any damaging effect from the weight of the conductor is eliminated during the vulcanizing process.

To control centering of the conductor in the insulation, constant X-ray readings in two adjacent quadrants are made through an aluminum window in the curing tube. These readings enable the operator to constantly check the wall thickness of the insulation.

Insulation compounded for performance. To overcome the eccentricity problem without the use of a vertical extruder may involve sacrificing desirable insulation properties. But, because General Electric solves this problem by a process rather than a formula, G-E chemists and engineers are free to formulate compounds with maximum *performance* characteristics. These characteristics include increased resistance to heat, moisture, ozone, and aging.

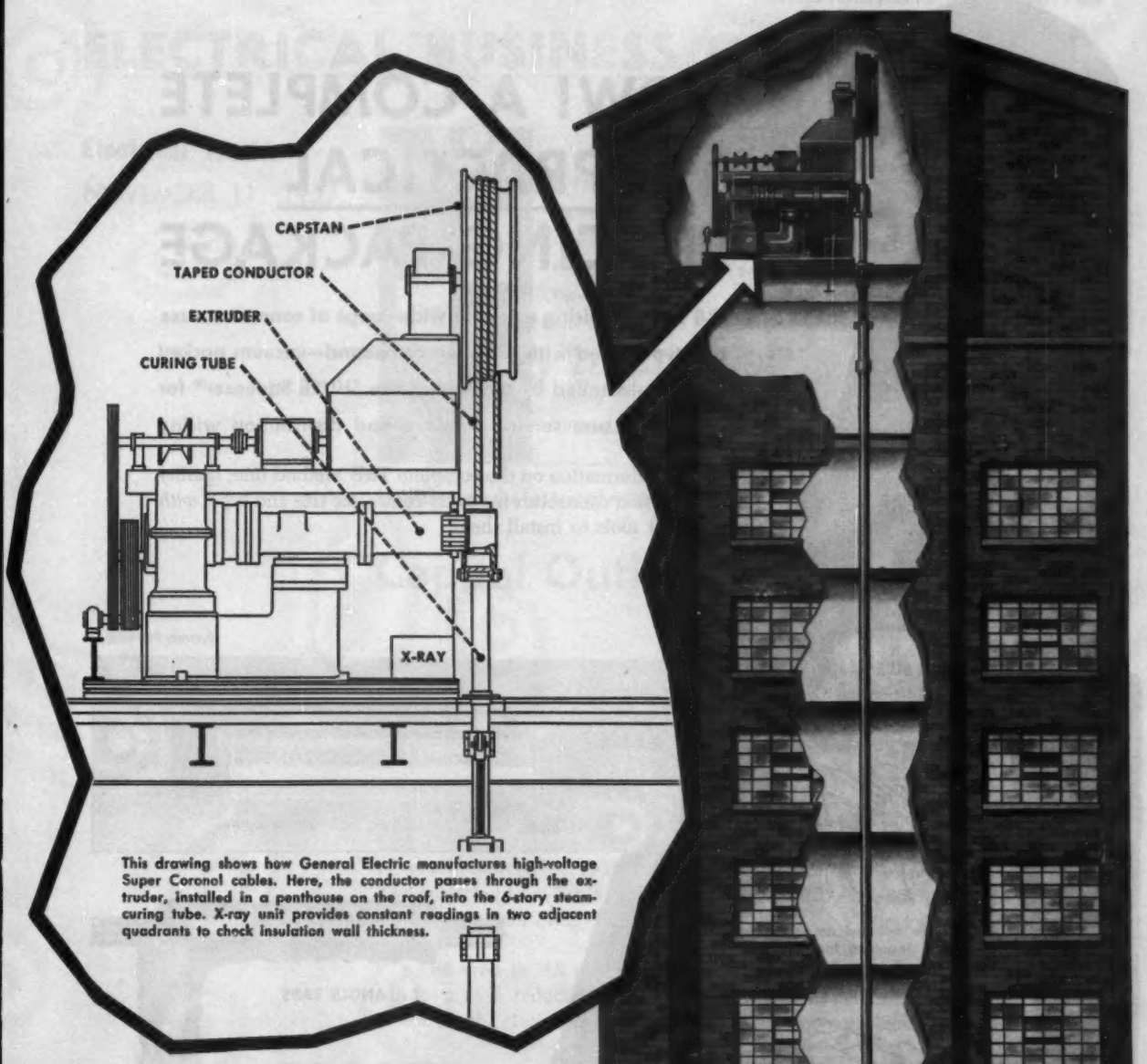
G-E Super Coronol Cables offer many advantages over other types of cables in high-voltage applications. Under equivalent loads, they cost less per ampere than cables with lower temperature ratings. They can safely carry heavier loads and they last longer. They're also lighter, more flexible, and easier to install. And you can install them directly in the ground or overhead.

Consider the many advantages of G-E Super Coronol cables the next time you plan a generating station or distribution system installation. For literature write Section W219-1127, General Electric Company, Wire and Cable Department, Bridgeport 2, Conn.

*Registered Trade-mark General Electric Company

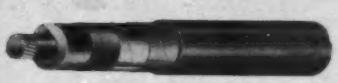
Progress Is Our Most Important Product

GENERAL ELECTRIC

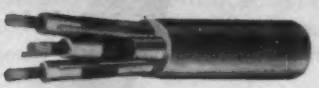


This drawing shows how General Electric manufactures high-voltage Super Coronol cables. Here, the conductor passes through the extruder, installed in a penthouse on the roof, into the 6-story steam-curing tube. X-ray unit provides constant readings in two adjacent quadrants to check insulation wall thickness.

GENERAL ELECTRIC SUPER CORONOL GEOPRENE* CABLES



POWER CABLE
Single-conductor, 15,000 volts

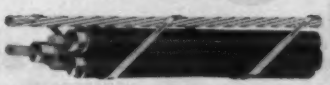


POWER CABLE
Three-conductor, 5,000 volts

POWER CABLE
Single-conductor, 5,000 volts

CONTROL CABLE
Multiple-conductor, 5,000 volts

SUBMARINE CABLE
Three-conductor, 5,000 volts



AERIAL CABLE
Three-conductor, 5,000 volts

NOW! A COMPLETE PRACTICAL SPLICING PACKAGE

T&B SHURE splicing means a wide range of connector sizes and types filled with T&B joint compound—vacuum packed in vinyl—installed by the pocket size SHURE Squeezer® for easy, fast, sure service entrance and distribution wiring

Ask for information on the complete T&B Method line; quality compression connectors for every conductor size and type, *with* the right tools to install them.

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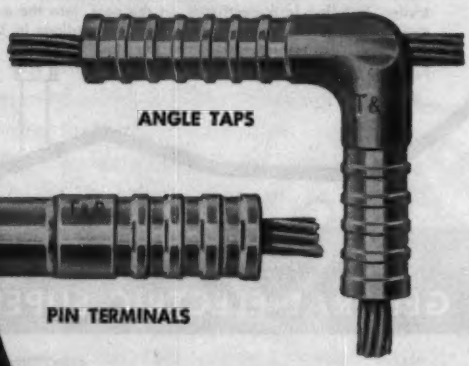
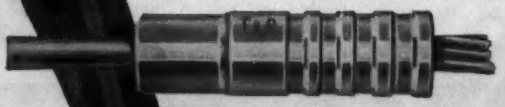
Splicers are mounted on perforated cards with installing instructions on back. Tear off only what you need.

SHURE feature makes it impossible to remove tool without taking the full bite... assures perfect compression every time.

Patents Pending



ANGLE TAPS



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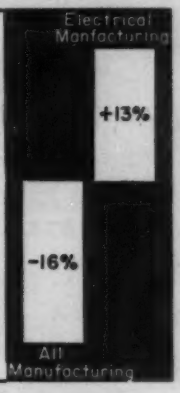
ELECTRICAL BUSINESS OUTLOOK

Electrical World
NOVEMBER 11, 1957

Industry	Plans for '58 (millions)	Change from '57 (%)
All Manufacturing	$11,614	down 16
Commercial	$6,885	down 1
Electric & Gas Utilities	$6,441	up 3
Petroleum	$6,038	up 1
Railroads	$1,064	down 27
Other Transportation & Communications	$4,575	up 1
Mining	$375	down 18
All Business	$36,059	down 7



Utilities and electrical manufacturers will buck the trend in '58 as . . .

Capital Outlays Take a Breather

Business spending for new plant and equipment will be down a bit in 1958. All told, industry is now planning to pare its capital expenditures down to $36.1 billion next year, according to the preliminary '58 survey just released by the McGraw-Hill Dept of Economics. Results of the survey show that:

• **Business now plans to cut investment in 1958 by 7% overall,** as compared with 1957. And most companies plan to stay at their reduced levels in 1959. However, outlays for 1958-59 are still high compared to most previous years. The projected level for '58 is 20% more than actual spending in 1955 and only slightly less than outlays in 1956.

• **The drop in '58 spending is concentrated in manufacturing**—where plans call for a 16% reduction next year. Offsetting this cutback is a planned increase of 8% by the electric utilities and a small gain by petroleum.

• **Main reason for the drop is a steady rise in manufacturing capacity—while production has been levelling out.** On the average, manufacturing companies were operating at 82% of capacity in September.

• **Most companies plan to maintain or increase expenditures on research** and development in 1958. About one-third of the companies in the survey plan to make substantial capital expenditures, after 1959, as a result of these research programs. The impact is especially strong in the electrical, chemical, rubber and paper industries.

Electric utilities emerge as the big off-set in the softening investment picture. Plans by investor-owned companies call for an 8% hike over this year's record $4 billion outlays. Of course, the percentage increase doesn't match the whopping 30% in 1957. But unlike most of the large capital spenders, the utilities are not cutting back in '58. According to the McGraw-Hill figures, some sort of a decline may show up in 1959. In their preliminary plans for that year, about 45% of the electric companies said they'd be spending less than in '58. (*More*)

Investment in most non-manufacturing industries is holding up well in 1958, although to a lesser extent than utilities. The petroleum industry—which is spending a record $6 billion this year—plans a small increase of 1%. In the commercial group (large chains, department stores, banks and insurance companies) the drop in '58 is a mild 1%. Only in mining and railroads are the cutbacks really sharp, off 18% and 27% respectively. The point is an important one, since together the non-manufacturing groups account for almost two-thirds of all business spending for new plant and equipment.

But in manufacturing industries the cutbacks run really deep. Manufacturing companies as a group plan to spend $11.6 billion or 16% less than in 1957. Within this category, autos will be off 30%, iron and steel 24%, and machinery 17%. The big exception in next year's picture is electrical machinery, where the spending total will run to $738 million—up 13% from 1957.

Excess capacity gets most of the blame for the reduction in manufacturing outlays for new plant and equipment. What with the boom in investment over the past few years, manufacturing capacity is now some 13% greater than at the end of 1955 (see chart). Yet over the same period actual production has registered practically no gain at all. According to the McGraw-Hill survey, manufacturing industries as a whole are now turning out only 82% of potential output. Since most companies prefer an operating rate of 90%, the present gap is clearly one which prompted a downward adjustment in '58 expansion plans.

As for 1959, most companies do not plan further cutbacks from the '58 level. Some 52% of the companies think that their expenditures will be the same as in 1958, 28% anticipate a further decline, and 20% see an increase. Of course, these are preliminary plans, and in many cases incomplete. But they do seem to indicate that the 7% drop next year will not accelerate into a more drastic slump in 1959.

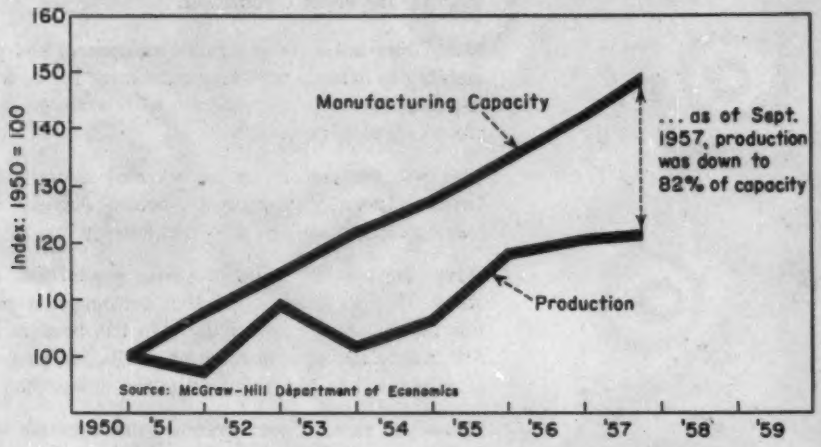
Research and development also gives a basic optimistic cast to the long-run investment picture. Some 95% of the companies in the survey plan to maintain or increase their research expenditures in 1958 (now running at about $7.3 billion). In dollar terms, of course, the increase won't offset the decline in capital expenditures. But, as we've pointed out before, the healthy boom in current research sets the stage for a new wave of capital investment in future years.

And when it comes to research, electrical manufacturers lead the pack. Two-thirds of the electrical equipment companies are increasing R&D in 1958. And 60% of these companies expect these expenditures to lead to substantial capital spending in 1959 or later.

Biggest drop is in manufacturing, where total outlays are off 16%

Industry	% Change 1956 to '57	% Change 1957 to '58	Industry	% Change 1956 to '57	% Change 1957 to '58
Autos, Trucks & Parts	down 29	down 30	Electric Machinery	up 8	up 13
Chemicals	up 23	down 4	Machinery (Non-electric)	up 17	down 17
Paper & Pulp	up 6	down 24	Iron & steel	up 39	down 24
Food & Beverages	up 4	down 10	Non-ferrous Metals	up 57	down 38
Textiles	down 15	down 23	Petroleum Refining	up 25	up 5

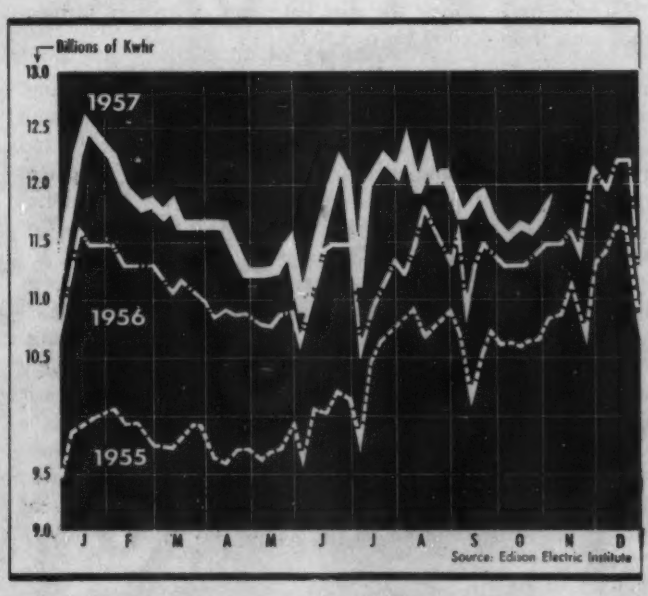
A widening gap between manufacturing capacity and production . . .



. . . is behind the reduction in capital spending planned for '58

Overall prospects for 1958 stand out in clearer perspective now that we have a good set of figures on capital expenditures. The drop in investment does mean that some of the steam will go out of the boom next year. And it does mean, with the wide gap between capacity and production, that 1958 is shaping up as a hotly competitive year for business. But the adjustments don't add up to a major recession with the bottom dropping out of the market for capital goods. By any past standards, investment will still be running at a very high level. In short, spending is down—but definitely not out.

STATISTICS



OUTPUT

Week ended November 2, 11,860,000,000 Kwhr Up 3.2%

Per Cent Change From Previous Year

	Oct. 19	Oct. 26	Nov. 2
Total U. S.	+3.1	+3.5	+3.2
New Eng.	+5.8	+1.8	+4.2
Mid. Atlan.	+2.5	+2.5	+1.7
Cent. Ind.	+2.6	+7.2	+2.5
West Cent.	+6.2	+5.3	+5.9
Southeast	+4.5	+4.5	+6.4
South Cent.	+1.5	+0.0	+4.4
Rocky Mount.	−0.3	+2.4	−1.1
Pacific			
NW	+1.4	+3.9	−3.5
SW	+2.9	+3.5	+4.5

Seasonally Adjusted Index 226.8
Week Ago 226.8
Year Ago 219.7

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 4.3%

MANAGEMENT BULLETIN

ECONOMICS ▶ **The electric utility industry cannot look much longer** to decreased fuel consumption and to lower unit costs of bigger and bigger power generating equipment to offset the effect of inflation.

Many innovations in generating equipment and plant design are still ahead but inability to balance mounting equipment prices with savings in fixed and operating cost may force the industry to reverse the downward trend of the price of electricity to its customers.

This was the essence of the warning contained in a statement presented by General Electric Co recently, before a group of executives representing the leading electric utilities of the country. Text of the statement follows:

"Over the past 50 years of power production, there has been a reduction of about 3% per year in the fuel consumption per kwhr of the average plant. For the last 5 or 6 years the gain has been at a somewhat greater rate, 4 to 5%, due to the rapid installation of efficient postwar power plants. This increase in economy has just about offset the inflationary fuel cost increases.

"However, there is good evidence that this rate of improvement will be reduced in the next 2 or 3 years to around 2% per year. From then on it will be a struggle for the industry to improve average power plant fuel consumption at a rate of much more than 1% per year for the next one to two decades.

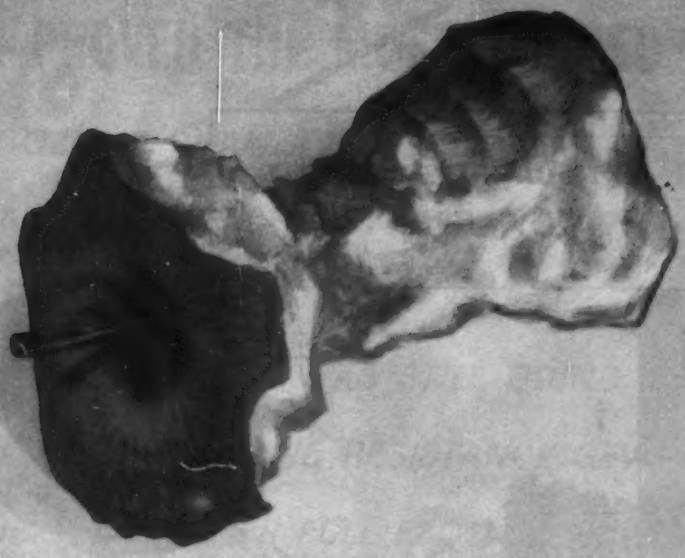
"From the standpoint of the first cost of plant over this same 50 year period, the industry has the advantage of a greatly reduced cost per unit of installed capacity resulting from the installation of bigger and bigger units. This has about offset the inflationary increases in equipment and construction costs.

"Today, however, there is much evidence that the unit cost of the principal components of the power plant may not decrease much beyond 200,000 kw capacity. But the increased utilization of the plant itself with larger units will continue to improve the over-all first cost per unit of output for the plant as a whole as turbine-generator and boiler ratings continue to grow probably up to the half million kw unit size.

"Much of the inherent reduction in plant first cost resulting from increasing unit capacity, alone, has been made during the past ten years as average turbine-generator rating has gone from 40,000 kw to 120,000 kw this year.

"If basic fuel consumption gains per year are reduced to 1% or so; if the limit of major gains in power plant first costs to be attained from increased unit ratings has been reached with units of 200,000 to 300,000 kw capacity; and if the inflationary trends in labor and material, and hence heavy equipment costs, continue at 5 to 6% or more per year—it will be necessary for utilities and rate-making bodies to face up to the realities of possible future increases of power costs in terms of then current dollars."

We might add that electrical manufacturers have been attempting to keep prices down to the maximum possible extent by cost reductions, many of which have been made possible by the installation of new and costly machine tools. Overall, the utility industry and the manufacturers involved have done a very commendable job over the past half century in making it possible for their technological improvements to offset the inflationary trends. The fact that a careful analysis of the situation discloses that the industry may be at a critical turning point at this time, in which further advances in technology may not be sufficient to offset the increasing inflationary trends, is an important development and the manufacturers are to be commended for calling this to the industry's attention.



WHO OUGHT TO PAY FOR THE APPLE?

Common logic says, the man who ate it. He receives the benefit, nobody else.

But those who favor "public power" don't concur. They say some people should get the electricity that they consume tax free—and others should ante up the difference with a smile.

The reasoning of the "public power" advocates goes like this: The water that generates power is a gift of nature and should not be allowed to fall into private hands.

Gift of nature it is—like coal, oil, minerals, or any other natural resource. But no resource has any special value until it is extracted, harnessed, or otherwise made useful by human effort. And this effort, which is "privately" exerted by individual men and women, is the real cost of the final product and accounts for by far the greater portion of its price.

Whether produced by "public" or "private" agencies, the power extracted from water, or any source, must still be paid for. And the payment must cover essentially the same costs—labor, tools, materials, and the interest on invested funds.

The "public power" people further say there is a saving when public power agencies do the job, since such agencies pay no taxes. But taxes "saved" by public power agencies are lost to the public treasury and have to be recovered from some other source. What people appear to save as consumers of "public" power, they must give back as taxpayers. Some people do benefit, sure—but at the expense of others. There is no saving to the people as a whole.

So the question of power boils down to this: Under what type of organization—"private" or "public"—is power most likely to be produced most economically, and paid for by those who reap the benefits?

The Western World gave its answer many years ago, after centuries of unhappy experience with "public" control of economic activity.

The answer has paid off richly in terms of efficiency, equity, and freedom.

Are we going to let those gains spill over the dam?*

*Based on material from The Guaranty Survey, published by Guaranty Trust Company of New York.

Leaflets, reprints and newspaper mats available at cost in page size for publication of this message locally over the signature of your company. Address EW-1, Guaranty Trust Company of New York, 140 Broadway, New York 15, for further information.

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To begin the test for ozone resistance, these six samples of competitive neoprene jackets were stretched 200% of original length and put in a test chamber with ozone held at .025% to .030% volume.

K-W POWER CABLE—PROVED THE MOST RUGGED

IN THE BUSINESS BY AN OZONE CHAMBER TEST OF POWER CABLE JACKET SAMPLES: WHILE JACKETS FROM THE FIVE LEADING COMPETITORS FAILED IN TWO AND ONE-HALF HOURS OR LESS, K-W NEOPRENE JACKET WAS STILL GOING STRONG...FOR 18 HOURS! THAT'S OZONE RESISTANCE SEVEN TIMES AS GOOD AS THE NEXT BEST! FOR FULL FACTS ABOUT HIGH-VOLTAGE K-W POWER CABLE, CALL YOUR K-W DISTRIBUTOR OR CONTACT THE NEAREST SALES OFFICE OF...

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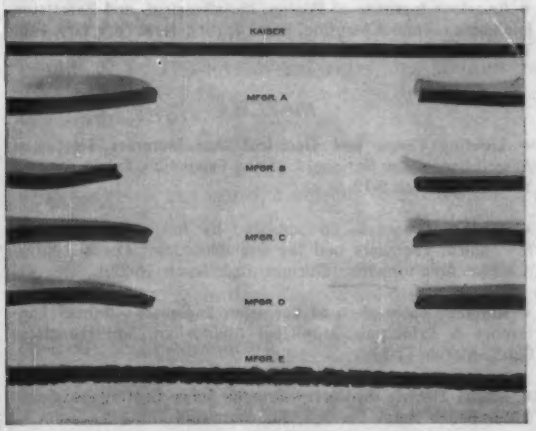
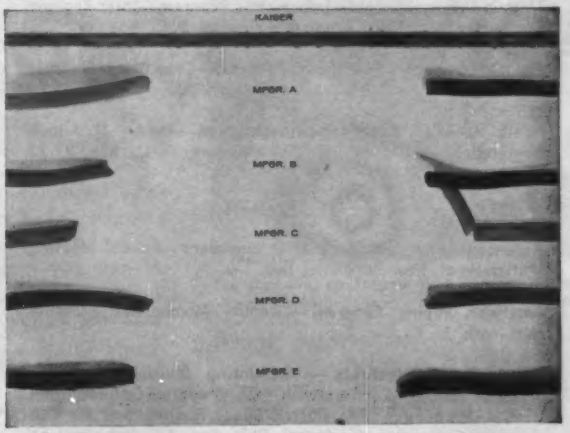
Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.



Two hours and 23 minutes after the start of the test, Brand E is disintegrating. Brand B failed 13 minutes earlier, and the other brands failed an hour or more before. The KW jacket shows no sign of damage.



After seven hours of the test, KW Power Cable's jacket is just beginning to show signs of minor damage. (Brand E failed after two hours and 30 minutes.) The KW jacket did not fail until after 18 hours of exposure!

MEETINGS CALENDAR

NOVEMBER

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 11-13; Radio Fall Meeting, King Edward Hotel, Toronto, Canada, Nov. 11-13; Mid-America Electronic Convention, Municipal Auditorium, Kansas City, Mo., Nov. 13-14; New England Radio Engineering Meeting, Mechanics Bldg., Boston, Massachusetts, November 15-16.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

Edison Electric Institute—Southern Region Home Service Workshop, Atlanta, Ga., Nov. 12-13; Commercial Lighting Committee, Washington, D. C., Nov. 14-15; Accounting Division Advisory and Executive Committees, The Cloisters, Sea Island, Ga., Nov. 14-15; Street Lighting Committee, Dayton, Ohio, Nov. 21-22; Industrial Power & Heating Group, Atlantic City, N. J., Nov. 21-22.

Pacific Coast Electrical Association—Services Section, Villa Hotel, San Mateo, Calif., Nov. 13-14.

American Standards Association—Eighth National Conference, St. Francis Hotel, San Francisco, Calif., Nov. 13-15.

Pennsylvania Electric Association—Electrical Equipment Committee, Ben Franklin Hotel, Philadelphia, Pa., Nov. 14-15.

Southeastern Electric Exchange—Accident Prevention Committee, Dinkler-Tutwiler Hotel, Birmingham, Alabama, November 14-15.

American Society of Refrigerating Engineers—44th Semi-annual Meeting, Shoreland Hotel, Chicago, Illinois, Nov. 14-16.

Canadian Electrical Association—Western Zone, General & Sales Divisions Meeting, Saskatchewan Hotel, Regina, Nov. 14-15; Engineering Division Meeting, Macdonald Hotel, Edmonton, Nov. 18-19.

Air Conditioning & Refrigeration Institute—10th Exposition, International Amphitheatre, Chicago, Ill., Nov. 18-21.

American Institute of Electrical Engineers—Ninth Annual Machine Tool Conference, Hotel Schroeder, Milwaukee, Wis., Nov. 4-6; Conference on Magnetism & Magnetic Materials, Sheraton Park Hotel, Washington, D. C., Nov. 18-21.

Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

Electric Companies Advertising Program—Copy Group Meeting, N. W. Ayer Studio, New York City, Nov. 20.

Public Utilities Advertising Association—Region II Annual Conference, Mayflower Hotel, Washington, D. C., Nov. 21-22.

DECEMBER

American Society of Mechanical Engineers—Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

American Mining Congress — Annual Membership Meeting, New York, N. Y., Dec. 2.

Edison Electric Institute — Accounting Division Electronics Seminar, sponsored jointly with AGA, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 2-4; Electric Space Heating and Air Conditioning Committee, Cincinnati, Ohio, Dec. 4-6; Industrial Relations Committee, sponsored jointly with New England Personnel Group, Sheraton Plaza Hotel, Boston, Mass., Dec. 5-6; Market Research Committee, Louisville, Ky., Dec. 5-6; Accounting Division Depreciation Committee, sponsored jointly with AGA, Lord Baltimore Hotel, Baltimore, Md., Dec. 9-10; Commercial Cooking & Water Heating Committee, Detroit, Mich., Dec. 12-13.

Interstate Power Club—Hotel Martinique, New York City, Dec. 9.

Electric Companies Public Information Program — Steering Committee, Palmer House, Chicago, Ill., Dec. 10.

Electric Companies Advertising Program—Management Group, Palmer House, Chicago, Ill., Dec. 12.

JANUARY—1958

International Home Furnishings Market — Including Appliance Show, The Merchandise Mart, Chicago, Illinois, January 6-7.

American Society of Heating and Air-Conditioning Engineers—64th Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-29.

Home Improvement Products Show — Hotel Sherman, Chicago, Ill., Jan. 27-29.

Industrial Heating Equipment Association — Penn Sheraton Hotel, Pittsburgh, Pa., Jan. 27-28.

FEBRUARY

National Rural Electric Cooperative Association — Annual Meeting, Dallas, Texas, Feb. 2-6.

Edison Electric Institute—Industrial Electrification Heating Conference, co-sponsored by Industrial Electric Council, Cincinnati, Ohio, Feb. 3-6.

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotels, New York City, Feb. 3-7.

Missouri Valley Electric Association — Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 6-7.

NATIONAL ELECTRICAL WEEK WILL BE OBSERVED FEBRUARY 9-15.

• **American Institute of Mining, Metallurgical, and Petroleum Engineers**—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

MARCH

• **Lighting Lamps and Electrical Manufacturers Salesmens Association**—First National Lighting Exposition, Coliseum, New York City, March 9-12.

• **Nuclear Congress**—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

• **National Association of Corrosion Engineers**—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

• **Edison Electric Institute**—Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

• **American Power Conference**—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

• Additions this week.

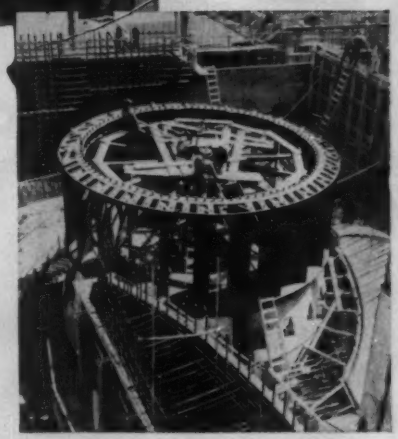
Eight B-L-H turbines to produce 640,000 hp at St. Lawrence Power Project

Shop assembly of stay ring and discharge ring for one of the eight turbines now being built by the Eddystone Division of B-L-H for the St. Lawrence Power Project.

Deliveries are now underway on an order for eight B-L-H fixed blade propeller turbines for the St. Lawrence Power Project. Each of these huge turbines is rated to produce 80,000 hp at 94.73 rpm under 81-ft. head. The first unit was recently delivered to the site of the powerhouse on Barnhart Island, N.Y. The last of the eight B-L-H units for this vast Canadian-American undertaking is scheduled to be completed and ready for shipment in December 1958.

The St. Lawrence Seaway and Power Project is the largest engineering feat ever performed on the North American continent.

Throughout the world, hundreds of hydroelectric plants are operating at maximum efficiency, thanks to B-L-H's 130 years' experience in designing and building hydraulic turbine equipment. Since we build all four basic types of turbine—impulse, Kaplan, Francis and propeller—you can be certain that our recommendations are objective. For additional information, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



The stay ring on Baldwin-built Unit No. 30 is being accurately aligned at the St. Lawrence Power Dam, Barnhart Island, N.Y. Photograph courtesy Power Authority of the State of New York.

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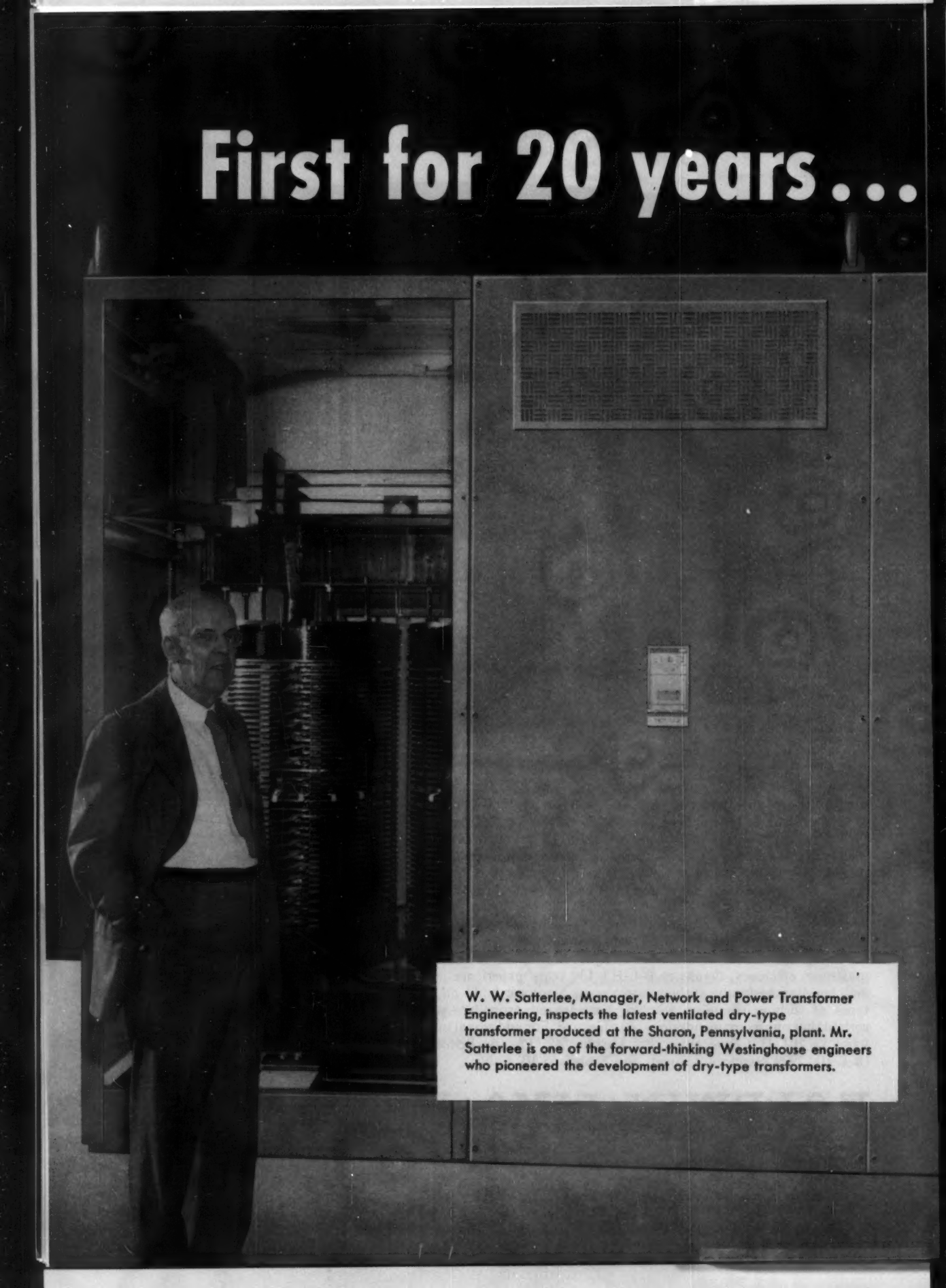


W. W. Satterlee, Manager, Network and Power Transformer Engineering, inspects the latest ventilated dry-type transformer produced at the Sharon, Pennsylvania, plant. Mr. Satterlee is one of the forward-thinking Westinghouse engineers who pioneered the development of dry-type transformers.

Safe, flexible Westinghouse dry-type transformers put your power where it's needed— at the center of the load

Twenty years ago, the first ventilated dry-type transformer was put into service. It was developed and built by Westinghouse. Since that time, Westinghouse has produced ventilated dry-type transformers with a total capacity of 5¾ million kva.

Fifteen years ago, the first sealed dry-type transformer was installed. This, too, was a Westinghouse development. Now, over 325 thousand kva of Westinghouse sealed dry-type transformers are in service.

This is the experience that stands behind every Westinghouse dry-type transformer—experience that has contributed to such factors as:

Safety—Westinghouse dry-type transformers need no vaults. There are no insulating liquids; no danger of either primary or secondary explosions.

Reduced installation costs—Requiring no special fire and explosion protection, Westinghouse dry-type transformers can be balcony-mounted. This not only reduces the original costs, but frees valuable floor space for other uses.

Reduced maintenance costs—Westinghouse dry-type transformers require little maintenance; no liquid to filter or replace.

Flexibility—Westinghouse dry-type transformers are flexible, can be located near the center of the load, with shortened secondary leads.

J-70830

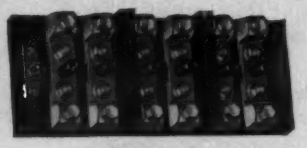
YOU CAN BE SURE...IF IT'S Westinghouse

This 7,500/10,000-kva ventilated dry-type unit substation transformer is the largest ever built. This unit utilizes Class B insulation, reducing fire hazards and eliminating danger of explosions.

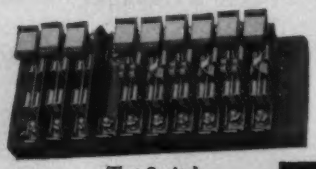
This 3,000-kva sealed dry-type unit substation transformer, with high-voltage terminal chamber and provision for connection to low-voltage switchgear, is the largest ever manufactured.

Look to Superior for

TEST SWITCHES AND BLOCKS



Test Block



Test Switch

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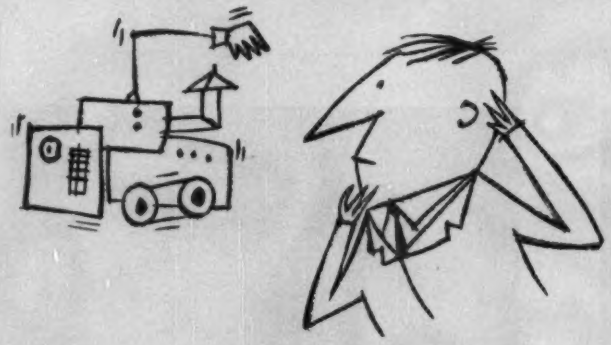

What's a "Whatsamatron"?

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AEIC Meeting

(*Continued from page* 60)

utilities must be ready to supply it.

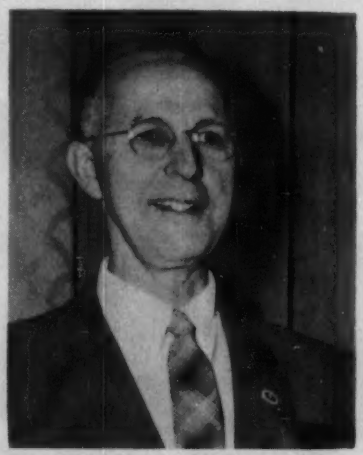
This new pattern of two annual peaks and a possible 25-year ultimate peak "may materially increase the investment per dollar of gross revenue," he declared. "It means that generation, transmission, and distribution additions must be advanced to spring service dates."

To meet these problems, TenBrook advised, utilities are giving more attention to acquiring right-of-way, to revising the traditional concepts of generating capacity reserve, and to research on extra-high-voltage cable, soil resistivity, and dc transmission.

The extra-high-voltage-cable project is moving along according to schedule, TenBrook reported. Two of the four manufacturers involved will have cable samples ready for laboratory tests this fall, and the other two in the spring. Field testing should start in 1959.

8 Load Research

Studies by the Load Research Committee pointed up the increasing

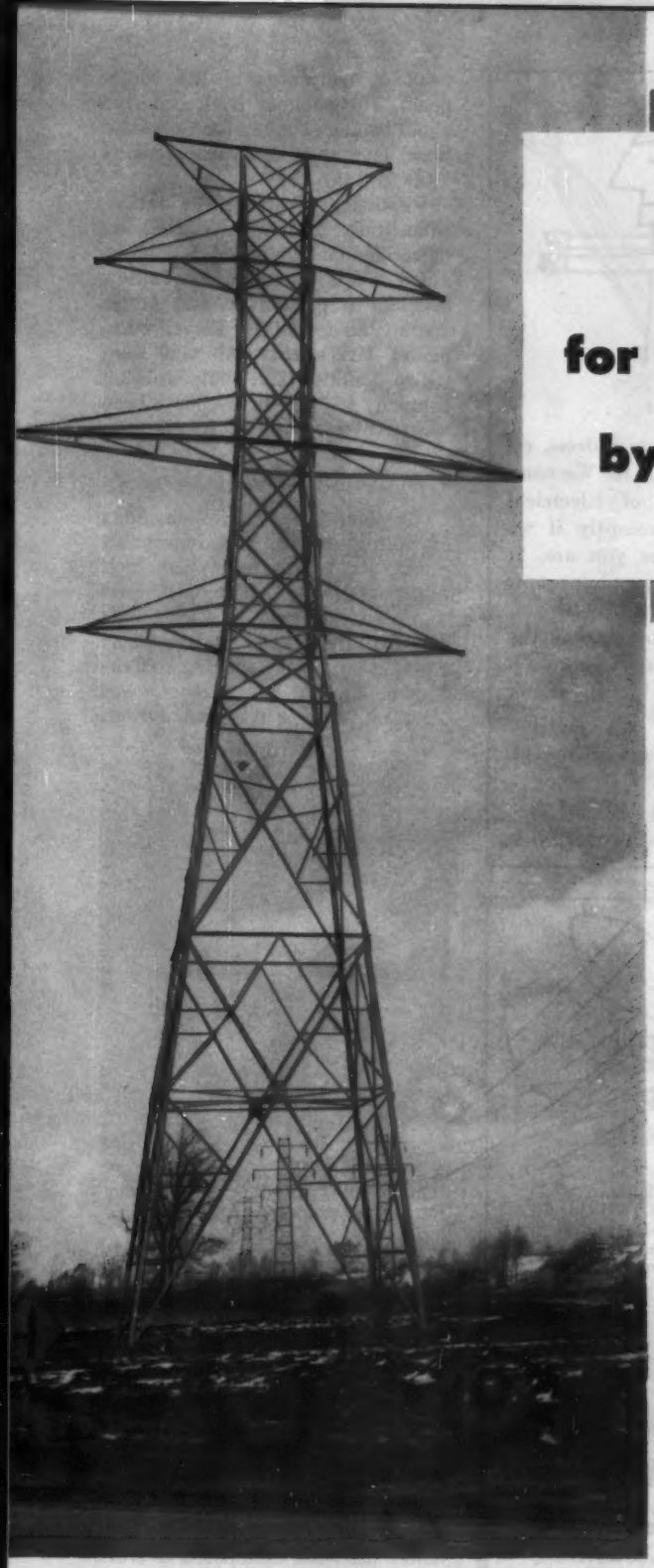


E. H. SCHMIDTMAN, Load Research

importance of summer loads, reported E. H. Schmidtman, committee chairman and assistant vice president, Wisconsin Electric Power.

One study showed that, for residential customers in six cities using less than 2,000 kwhr per year, diversified daily load curves on an average weekday had a summer

(*Continued on page* 139)



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3,500 tons of steel was involved in these towers—about 1,050 tons of which was USS MAN-TEN. The use of this high strength steel in all main legs and some of the main bracing—about 7½ tons per tower—reduced tower weight by 2,400 pounds (about 165 tons on the entire line), or about 5% savings in over-all weight.

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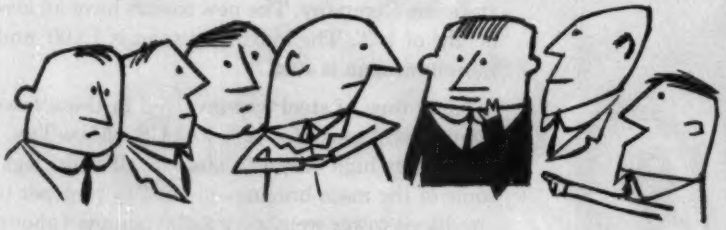

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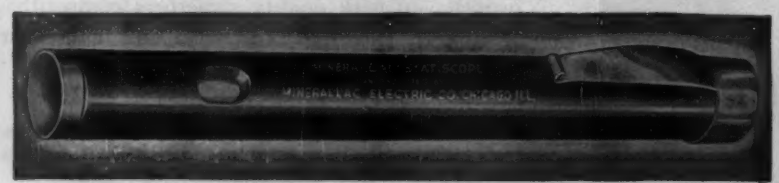

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peak of two-thirds of the winter peak. The summer peak occurred about two clock hours (one standard hour) later than the winter peak of 7:00 to 8:00 PM.

Reporting progress in a nationwide study of load characteristics of residential lighting, Schmidtman noted that 23 companies have now decided to participate and others are invited to do so. Eleven companies have started tests, and Kentucky Utilities Co, "the lead-off company in this survey," has been testing five customers for a year.

9 Appliances and Servicing

"It should be the responsibility of utilities to see that reasonably priced service is available in their respective areas." This positive statement of utility action was adopted by the Committee on Appliances and Servicing, chairmanned by W. H. Wagner, vice president, Wisconsin Electric Power.

W. H. WAGNER, Appliances

The individual utility could encourage independent servicing agencies, urge manufacturers to set up servicing centers, or set up its own servicing unit. The NEMA Committee on Appliances suggested that utilities could maintain a directory of qualified service establishments for customers' reference.

Wagner also reported that a permanent NEMA Appliance Committee has been established to work with the AEIC Committee on the appliance service problem. These two groups devote primary consideration to interchangeability; availability of parts, tools, and

service information; and service problems of built-in appliances.

10 Research in Sales

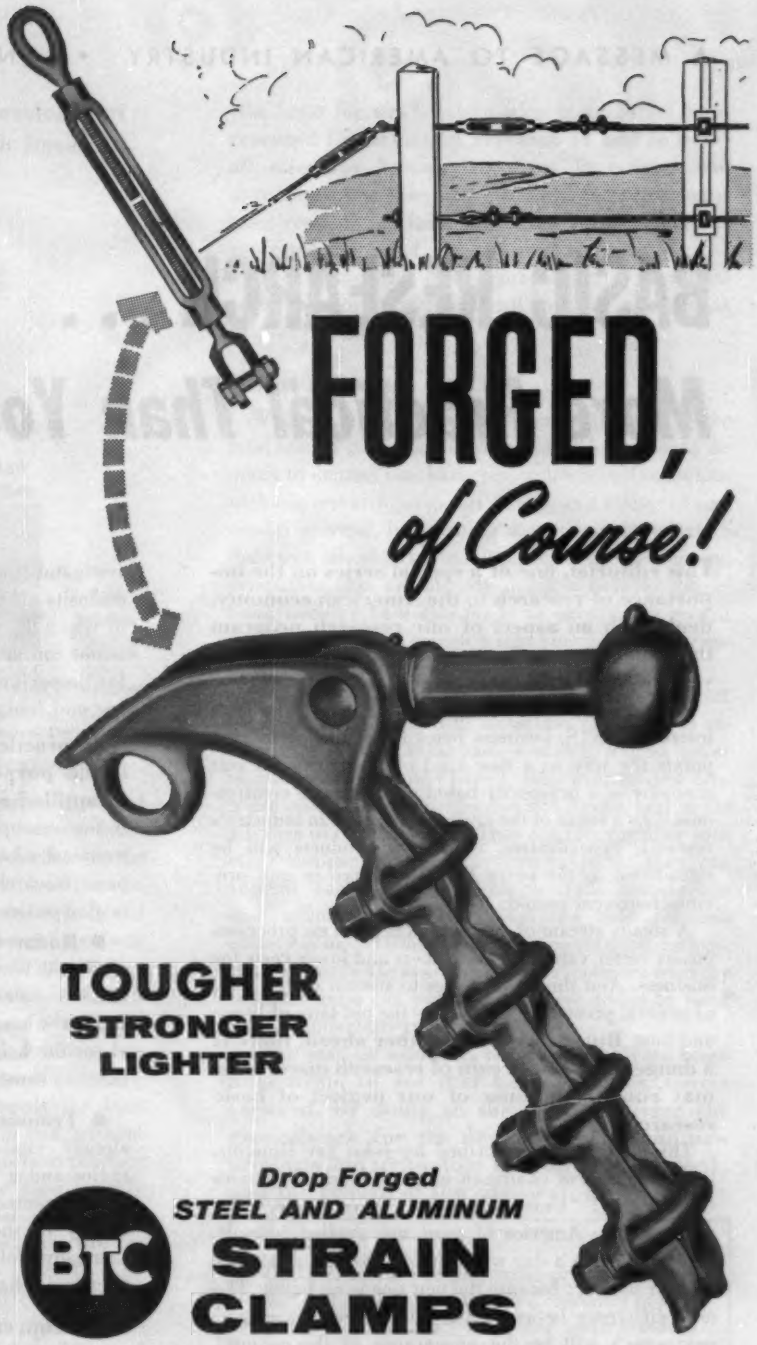
"In today's complex, dynamic market, the old method of using guesses and hunches to guide sales action just won't work," warned E. O. George, vice president, Detroit Edison Co. "It must be thrown out. In its place we need sales research that will give us pertinent basic data on which to base plans and decisions."

E. O. GEORGE, Sales Research

George called attention to these facts: Nationally, the rate of residential sales increase has been leveling off for the past three years; appliance's portion of spendable income for durable goods has slipped 4% since 1950; and fixed costs in the future are going to take proportionately more of earned revenue. In view of these circumstances, he warned, "we face serious problems in supporting our capital expenditures for the next 5 years."

This situation can be remedied only by more revenue—which means, more effective sales tools; and finally, sales research. George outlined three sales research areas:

- Market analysis—determining the approach to our markets that will give the best return for dollars spent.
- Budget—determining the amount of money that should be spent on promotion and sales under varying market conditions.
- Control—evaluating sales results.



BASIC RESEARCH . . .
More Practical Than You Think

This editorial, one of a special series on the importance of research to the American economy, deals with an aspect of our research program that may have serious consequences in future years — the lag in basic research.

An earlier editorial in this series noted: "The keen interest of U. S. business firms in scientific research points the way to a new kind of prosperity for our economy — a prosperity based on deliberate creativeness." As a result of the dramatic increase in industry's research expenditures, more new products will be introduced in the years 1957-1960 than in any previous four-year period.

A steady stream of new products and new processes means better values for consumers and lower costs for business. And thus it promises to sustain a high level of general prosperity that defies the old laws of boom and bust. **But, as we look further ahead, there is a danger that the stream of research discoveries may run dry because of our neglect of basic research.**

This danger was described by John Jay Hopkins, late founder and chairman of the General Dynamics Corporation: "Unless there is a revolutionary development in America of pure, not applied, science, there will come a day when there is no use in trading in your old car; because the new one is no better. The only difference between this year's television set and next year's will be the appearance of the cabinet! Scientific progress will be replaced by scientific stagnation."

What Basic Research Is

Basic (or pure) research has been characterized as the pursuit of knowledge for its own sake rather than to fulfill some practical objective. It is generally carried out in an environment which allows the investigator the freedom to follow the lead of his curiosity. The scientist in basic research, in the words of Glenn T. Seaborg of the University of California, is not concerned with "utilitarian goals, but a search for deeper understanding of the universe and the living and inorganic phenomena within it."

Impractical as basic research may seem in its initial purpose, it is an essential prerequisite to applied research and product development. A few examples will show how some of the greatest technical advances of recent years have come from basic research projects that had no immediate practical objective:

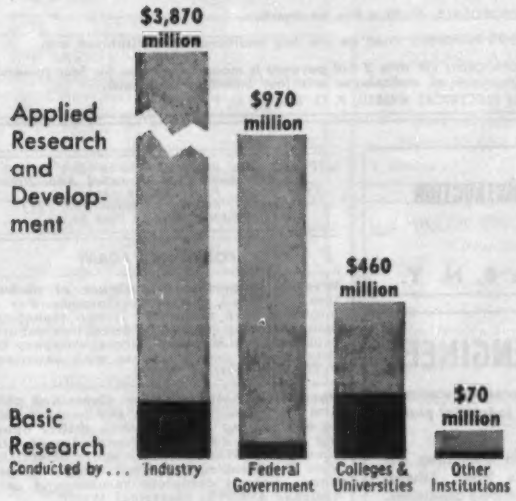
- **Radar** — an important military development of World War II with broadening commercial applications — was the outgrowth of a basic research project whose purpose was to obtain information about the height of the ionosphere, the layer of air that lies some 25 miles above the earth's surface.

- **Transistors** — the miniature devices which are already vital components of hearing aids, pocket radios and a wide variety of industrial equipment — were invented at Bell Laboratories (research subsidiary of the American Telegraph and Telephone Company) following university investigations into the electrical behavior of solids.

- **Neoprene** — a synthetic rubber — was developed by duPont with the help of basic information provided by Father Nieuwland of Notre Dame, who discovered he could control the polymerization (the linking together of molecules) of a certain class of organic compounds.

- **Nylon** — the first of the noncellulosic synthetic fibers that have revolutionized the textile industry — grew out of fundamental research by Dr. Wallace Carothers on long-chain polymers.

Only 8% of All Research and Development in the U. S. is Devoted to Basic Research



Data: National Science Foundation, "Funds for Basic Research in the United States, 1953"

Industry's Stake in Basic Research

Industry traditionally has relied upon colleges and universities and other nonprofit institutions for basic research; and the U. S. has long benefited from the greater emphasis placed on basic research in Europe. It is conventional to think that business cannot, and should not, do much about "ivory tower" projects which do not have immediate practical application.

However, there is not so much in this idea as is supposed. The examples above illustrate what Caryl Haskins, president of the Carnegie Institution, has called "the widespread paradox that the most important practical consequences are commonly the least sought after." Furthermore, it is certain that, without adequate basic research, industry's efforts to produce new and better products will become progressively more difficult. And our national defense, in an age of breathtaking military applications of science, will become increasingly precarious.

In the past, our economic growth came largely through expansion into new lands or through discovery and development of rich deposits of natural resources. Such opportunities are relatively limited today. The great opportunities now lie in discovering new materials and new properties of the materials we already have. **This is the job of basic research, and industry has a vital stake in it.**

The chart indicates the tiny share of research efforts in the U.S. that is devoted to basic research. **Only 4% of all research by industry, and only 8% of all research in the U.S., during the year 1953** (the latest for which information is available) **represented fundamental research to add to overall scientific knowledge.** Even in colleges and universities less than half the research performed is basic research. At least one Nobel Prize winner has expressed the belief that we need and should work toward a doubling of the proportion of our total research effort that is devoted to basic research as soon as possible.

What Business Can Do

Without anything like a staggering increase in the total cost of its research programs, industry could do much to expand our basic research effort. Companies with big research programs should, as a matter of successful survival, be devoting a share of the effort in their own laboratories to basic research. Significantly, companies that are already doing a notable job of basic research have also made an outstanding record of translating such research into new products for industry and the consumer.

Smaller companies may rightly regard the conduct of research projects with uncertain prospects of reward as a luxury. Some basic research, indeed, never results in any tangible payoff. But, with modest contributions, small companies can still have a part in the advance of basic research. They can join together with other companies on cooperative projects. They can support basic research through trade associations and technical societies. They can help research centers in universities and other nonprofit institutions. Arrangements are available in some instances whereby business firms can pay a fee to have access to work done by university researchers.

One way or another, it is up to private business firms to see that basic research moves forward. By doing so they will be laying the groundwork for the development of the new products and technology on which their growth, and the growth of the economy, depend.

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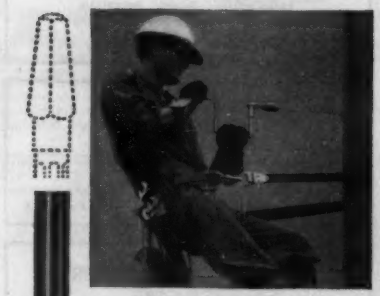

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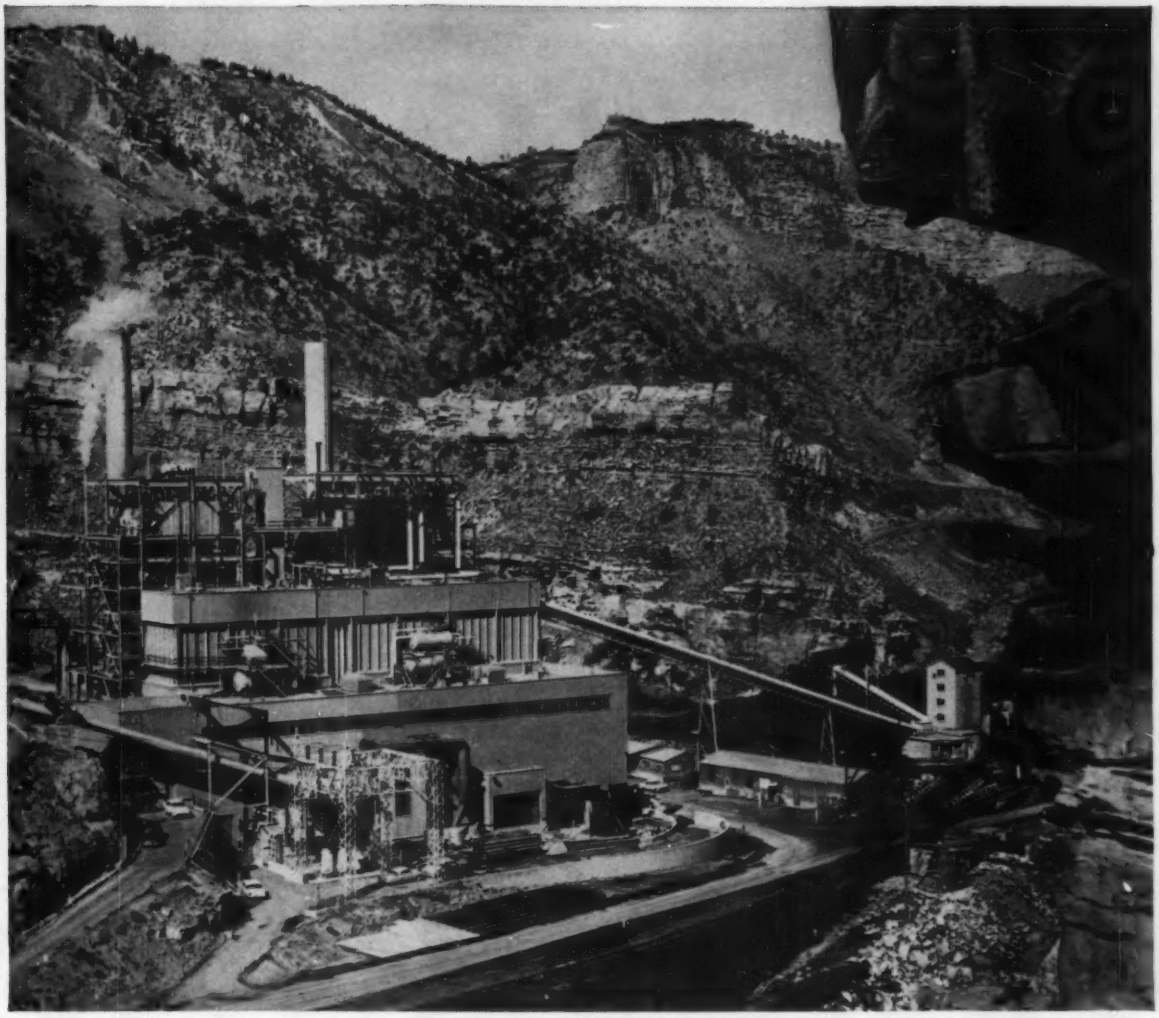
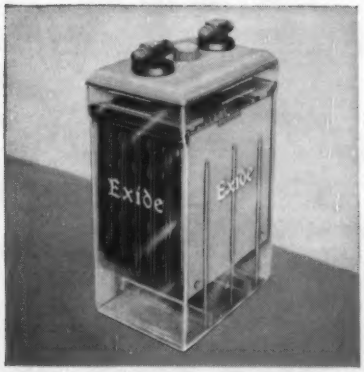


UTAH POWER & LIGHT CO.—Carbon steam-electric plant, Castle Gate, Utah

Leading Power Companies Use Exide Batteries



Dependable power. Exide-Manchex type battery typical of those used at the Carbon plant.

The Carbon steam-electric plant at Castle Gate, Utah Power's second largest, provides an additional 166,000 kilowatt capacity for rapidly growing southeastern Utah. Located in the heart of the state's coal region, this is the first central generating station to be constructed in the area.

Basic to the job of keeping the plant producing is the 60-cell Exide-Manchex Battery for control and emergency service. It provides power to trip and close switchgear and for emergency lighting and bearing lubricating pumps; also standby power for the substation control house.

Exide-Manchex Batteries have set records for dependable service and long life. This is due to their unique construction. Lead buttons locked into a corrosion-resistant grid form a positive plate high in strength and activity over years of use. No other battery can offer the same advantages. For complete information, contact your nearby Exide man. Or write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

Exide®

"Salesman of the Week" If you can identify this Kuhlman representative, notify Dept. SA-1, Kuhlman Electric Co., Birmingham, Michigan

"This BEND makes lighter distribution transformers possible...."

"Primarily, the core determines the weight and size of a distribution transformer. Low-loss cores require less core steel, less copper in the windings, smaller tanks, less cooling oil and ultimately result in a reduction of overall dimensions.

"The problem then is to design lighter, smaller cores. How is it done?

"Well, actually, the solution was found more than a quarter of a century ago. It was then that Kuhlman first introduced the revolutionary idea of bending core iron to provide a continuous low-loss path for magnetic flux. This Kuhlman invention, utilizing the characteristics of grain-oriented steel, has been the basis of core development since.

"In recent times, bent iron cores, as opposed to stacked-lamination designs, have been responsible for such major improvements as: 100 KVA reduced to the former weight of a 75 KVA unit—75 KVA to the former weight of a 50 KVA unit, and so on down the line.

"Today, virtually all transformer manufacturers use some form of bent iron core. The original Kuhlman name 'Bent Iron' core is well worth remembering—for in all its adaptations, it's still the ***Bend*** that is the key to today's lightweight distribution transformers."

5720B

KUHLMAN ELECTRIC COMPANY

GENERAL OFFICES: Birmingham, Michigan